

Chapter 2

Engine, clutch and transmission

Note: Unless specifically mentioned in this Chapter, the information given for the 1982 750 Sabre applies to the UK VF750S-C, and that for the 1987 and 1988 700/750 Magnas applies to the UK VF750C-H and C-J respectively.

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Specifications**General**

Capacity	
700 models.....	699 cc (42.6 cu in)
750 models.....	748 cc (45.6 cu in)
1100 models.....	1098 cc (67 cu in)
Bore	
700 and 750 models.....	70 mm (2.75 in)
1100 models.....	79.5 mm (3.13 in)
Stroke	
700 models.....	45.4 mm (1.79 in)
750 models.....	48.6 mm (1.9 in)
1100 models.....	55.3 mm (2.18 in)
Compression ratio	
700/750 models 1982 through 1986.....	10.5 to 1
700/750 models 1987 and 1988	10.2 to 1
1100 models.....	10.5 to 1
Engine weight (dry) - approximate	
700/750 models	85 to 87 kg (187 to 192 lbs)
1100 models.....	97 kg (213 lbs)

Camshafts

Cam lobe height - 1982 through 1984 700/750 models and all 1100 models	
Standard.....	35.355 to 35.495 mm (1.3911 to 1.3974 in)
Service limit.....	35.3 mm (1.39 in)
Cam lobe height - 1985 and 1986 700 models	
Standard.....	35.243 to 35.403 mm (1.3875 to 1.3938 in)
Service limit.....	35.2 mm (1.39 in)
Cam lobe height - 1987 700 models	
Standard.....	35.063 to 35.223 mm (1.3804 to 1.3867 in)
Service limit.....	35.0 mm (1.38 in)
Cam lobe height - 1988 750 model (except California)	
Standard.....	34.845 to 35.005 mm (1.3718 to 1.3781 in)
Service limit.....	34.8 mm (1.37 in)
Cam lobe height - 1988 750 model (California)	
Standard.....	34.562 to 34.722 mm (1.3607 to 1.3670 in)
Service limit.....	34.5 mm (1.358 in)
Camshaft runout	
1985 through 1988 700/750 Magna models.....	Less than 0.05 mm (0.002 in)
All other models	Less than 0.10 mm (0.004 in)
Camshaft bearing oil clearance -1982 through 1985 700/750 models	
Center journal	
Standard	0.030 to 0.091 mm (0.001 to 0.004 in)
Service limit.....	0.10 mm (0.004 in)
Inner and outer journals	
Standard	0.50 to 0.111 mm (0.002 to 0.004 in)
Service limit.....	0.12 mm (0.005 in)
Camshaft bearing oil clearance -1100 models	
Standard (all journals).....	0.030 to 0.091 mm (0.001 to 0.004 in)
Service limit (all journals).....	0.095 mm (0.0037 in)
Camshaft journal OD -1986 through 1988 700/750 Magna models	
Outer journal (A)	
Standard	23.949 to 23.970 mm (0.9429 to 0.9437 in)
Service limit.....	23.89 mm (0.941 in)
Center and inner journals (B and C)	
Standard	23.861 to 23.882 mm (0.9394 to 0.9402 in)
Service limit.....	23.80 mm (0.937 in)
Camshaft bearing holder ID - 1986 through 1988 700/750 Magna models Intake	
Standard	24.000 to 24.021 mm (0.9449 to 0.9457 in)

Service limit.....	24.05 mm (0.947 in)
Exhaust	
Standard	24.000 to 24.084 mm (0.9449 to
0.9482 in)	
Service limit.....	24.11 mm (0.949 in)

Camshaft bearing oil clearance - 1986 through 1988 700/750 Magna models

Outer journal (A) - intake and exhaust	
Standard	0.030 to 0.072 mm (0.0012 to 0.0028 in)
Service limit.....	0.10 mm (0.004 in)
Center and inner journals (B and C) - intake	
Standard.....	0.118 to 0.160 mm (0.0046 to 0.0063 in)
Service limit.....	0.20 mm (0.008 in)
Center and inner journals (B and C) - exhaust	
Standard	0.118 to 0.223 mm (0.0046 to 0.0088 in)
Service limit.....	0.25 mm (0.010 in)
Camchain length (at 13 kg/29 lbs)	
All 700/750 Sabres and 1982 through 1984 700/750 Magnas	
Standard	323.85 to 324.30 mm (12.750 to 12.767 in)
Service limit.....	326.12 (12.84 in)
1985 through 1988 700/750 Magna models	
Standard	342.90 to 343.35 mm (13.500 to 13.518 in)
Service limit.....	340.50 (13.405 in)
1100 models	
Standard	361.95 to 362.40 mm (14.250 to 14.269 in)
Service limit.....	364.90 mm (14.37 in)

Rocker arms

Rocker arm bore diameter	
Standard.....	12.000 to 12.018 mm (0.4724 to 0.4731 in)
Service limit.....	12.05 mm (0.474 in)
Rocker arm shaft outer diameter	
Standard.....	11.966 to 11.984 mm (0.4711 to 0.4718 in)
Service limit.....	11.93 mm (0.470 in)

Cylinder head

Maximum warpage	
All 700/750 Sabres, 1982 through 1984 700/750 Magna models	0.25 mm (0.010 in)
1985 through 1988 700/750 Magna models.....	0.10 mm (0.004 in)
1100 models.....	0.05 mm (0.002 in)

Valves, guides and springs

Intake valve stem OD	
Standard.....	5.475 to 5.490 mm (0.2156 to 0.2161 in)
Service limit.....	5.47 mm (0.215 in)
Exhaust valve stem OD	
Standard.....	5.455 to 5.470 mm (0.2148 to 0.2154 in)
Service limit.....	5.45 mm (0.214 in)
Valve guide ID - intake and exhaust	
Standard.....	5.500 to 5.515 mm (0.2165 to 0.2171 in)
Service limit.....	5.55 mm (0.219 in)
Valve stem-to-guide clearance	
Intake	
Standard	0.010 to 0.040 mm (0.0004 to 0.0016 in)
Service limit.....	0.08 mm (0.003 in)
Exhaust	
Standard	0.030 to 0.060 mm (0.0012 to 0.0024 in)
Service limit.....	0.10 mm (0.004 in)
Valve seat width - intake and exhaust	
Standard.....	0.99 to 1.27 mm (0.039 to 0.050 in)
Service limit.....	1.5 mm (0.06 in)
Valve spring free length - all 700/750 Sabre models, 1982 through 1984 700/750 Magna models	
Inner spring	
Standard	40.70 mm (1.60 in)
Service limit.....	39.35 mm (1.55 in)
Outer spring	
Standard	43.90 mm (1.73 in)
Service limit.....	42.43 mm (1.67 in)
Valve spring free length - 1985 through 1987 700 Magna models	
Inner spring	
Standard	39.49 mm (1.555 in)
Service limit.....	38.19 mm (1.504 in)
Outer spring	
Standard	44.61 mm (1.756 in)
Service limit.....	43.14 mm (1.698 in)

Valves, guides and springs (continued)

Valve spring free length - 1988 750 Magna model

Inner spring	
Standard	41.43 mm (1.631 in)
Service limit.....	40.13 mm (1.580 in)
Outer spring	
Standard	45.31 mm (1.784 in)
Service limit.....	43.84 mm (1.726 in)

Valve spring free length - 1100 models

Inner spring	
Standard	40.85 mm (1.608 in)
Service limit.....	39.45 mm (1.553 in)
Outer spring	
Standard	44.50 mm (1.752 in)
Service limit.....	43.10 mm (1.70 in)

Clutch

Friction plate thickness

Standard.....	3.72 to 3.88 mm (0.147 to 0.153 in)
Service limit.....	3.5 mm (0.14 in)

Plain plate maximum warpage

0.3 mm (0.012 in)

Clutch spring free length - except 1983 750 Sabre and all 1100 models

Standard.....	35.5 mm (1.40 in)
Service limit.....	34.0 mm (1.34 in)

Clutch diaphragm spring free height - 1983 750 Sabre and all 1100 models

Standard - 750 model	3.9 mm (0.15 in)
Standard - 1100 models	4.6 mm (0.18 in)
Service limit - all models.....	3.6 mm (0.14 in)

Outer guide inner diameter - 700/750 models

Standard.....	24.995 to 25.012 mm (0.9841 to 0.9847 in)
Service limit.....	25.08 mm (0.987 in)

Outer guide inner diameter - 1100 models

Standard.....	29.995 to 30.012 mm (1.1809 to 1.1816 in)
Service limit.....	30.08 mm (1.184 in)

One-way clutch inner piece outer diameter - 1983 750 Sabre and all 1100 models

Standard.....	57.755 to 57.768 mm (2.2738 to 2.2743 in)
Service limit.....	57.74 mm (2.273 in)

Outer center inner diameter -1983 750 Sabre and all 1100 models

Standard.....	74.414 to 74.440 mm (2.9296 to 2.9307 in)
Service limit.....	74.50 mm (2.933 in)

Master cylinder bore diameter - 700/750 models

Standard.....	14.000 to 14.043 mm (0.5512 to 0.5528 in)
Service limit.....	14.06 mm (0.554 in)

Master cylinder piston diameter - 700/750 models

Standard.....	13.957 to 13.984 mm (0.5495 to 0.5506 in)
Service limit.....	13.94 mm (0.549 in)

Master cylinder bore diameter -1100 models

Standard.....	15.870 to 15.913 mm (0.6248 to 0.6265 in)
Service limit.....	15.93 mm (0.627 in)

Master cylinder piston diameter -1100 models

Standard.....	15.827 to 15.854 mm (0.6231 to 0.6242 in)
Service limit.....	15.80 mm (0.622 in)

Slave cylinder bore diameter

Standard.....	38.100 to 38.162 mm (1.5000 to 1.5024 in)
Service limit.....	38.18 mm (1.503 in)

Slave cylinder piston diameter

Standard.....	38.036 to 38.075 mm (1.4975 to 1.4990 in)
Service limit.....	38.02 mm (1.497 in)

Lubrication system

Oil pressure (at switch)

700/750 models	64 ± 11 psi (4.4 ± 0.8 Bars) at 80°C/176°F
1100 models	71 ± 10 psi (4.9 ± 0.7 Bars) at 80°C/176°F

Oil pump rotor tip-to-outer rotor clearance

Standard.....	0.15 mm (0.006 in)
Service limit.....	0.20 mm (0.008 in)

Oil pump outer rotor-to-body clearance

Standard.....	0.15 to 0.22 mm (0.006 to 0.009 in)
Service limit.....	0.35 mm (0.014 in)

Oil pump rotor endfloat	
Standard.....	0.02 to 0.07 mm (0.001 to 0.003 in)
Service limit.....	0.10 mm (0.004 in)

Starter clutch

Driven gear OD - 700/750 models	
Standard.....	47.175 to 47.200 mm (1.8573 to 1.8583 in)
Service limit.....	47.16 mm (1.857 in)
Driven gear OD -1100 models	
Standard.....	54.170 to 54.200 mm (2.1327 to 2.1339 in)
Service limit.....	54.16 mm (2.132 in)

Cylinder block

Cylinder bore ID	
700/750 models	
Standard.....	70.000 to 70.015 mm (2.755 to 2.756 in)
Service limit.....	70.10 mm (2.76 in)
1100 models	
Standard.....	79.500 to 79.515 mm (3.1299 to 3.1305 in)
Service limit.....	79.60 mm (3.134 in)
Maximum ovality (out-of-round)	
700/750 models.....	0.10 mm (0.004 in)
1100 models.....	0.05 mm (0.002 in)
Maximum taper.....	0.10 mm (0.004 in)
Cylinder-to-piston clearance.....	0.010 to 0.055 mm (0.0004 to 0.0022 in)
Service limit.....	0.10 mm (0.004 in)

Pistons

Piston OD (measured 11 mm up from base of skirt)	
700/750 models	
Standard.....	69.960 to 69.990 mm (2.754 to 2.755 in)
Service limit.....	69.85 mm (2.750 in)
1100 models	
Standard.....	79.460 to 79.490 mm (3.1283 to 3.1295 in)
Service limit.....	79.35 mm (3.124 in)
Piston pin bore OD	
700/750 models	
Standard.....	18.002 to 18.008 mm (0.7087 to 0.7090 in)
Service limit.....	18.10 mm (0.71 in)
1100 models	
Standard.....	20.002 to 20.008 mm (0.7875 to 0.7877 in)
Service limit.....	20.06 mm (0.790 in)
Piston pin OD	
700/750 models	
Standard.....	17.994 to 18.000 mm (0.7084 to 0.7086 in)
Service limit.....	17.98 mm (0.708 in)
1100 models	
Standard.....	19.994 to 20.000 mm (0.7872 to 0.7874 in)
Service limit.....	19.98 mm (0.787 in)
Piston-to-piston pin clearance	
Standard.....	0.002 to 0.014 mm (0.0001 to 0.0006 in)
Service limit.....	0.04 mm (0.002 in)

Piston rings

Ring-to-groove clearance (top and second rings)	
Standard.....	0.015 to 0.045 mm (0.0006 to 0.0018 in)
Service limit.....	0.10 mm (0.004 in)
Top ring end gap	
Standard	
1982 750 model.....	0.10 to 0.30 mm (0.004 to 0.012 in)
1983-on 700/750 models.....	0.15 to 0.30 mm (0.006 to 0.012 in)
1100 models.....	0.20 to 0.35 mm (0.008 to 0.014 in)
Service limit.....	0.5 mm (0.02 in)
Second ring end gap	
Standard	
1982 750 model.....	0.10 to 0.30 mm (0.004 to 0.012 in)
1983-on models.....	0.20 to 0.35 mm (0.008 to 0.014 in)
Service limit.....	0.5 mm (0.02 in)

Piston rings (continued)

Oil control ring side rail end gap

700/750 models

Standard	0.2 to 0.9 mm (0.008 to 0.035 in)
Service limit.....	1.1 mm (0.04 in)

1100 models

Standard	0.2 to 0.7 mm (0.008 to 0.028 in)
Service limit.....	0.9 mm (0.04 in)

Connecting rods and bearings

Connecting rod side clearance (all models)

Standard.....	0.10 to 0.30 mm (0.004 to 0.012 in)
Service limit.....	0.4 mm (0.016 in)

Connecting rod piston pin bore ID

700/750 models

Standard.....	18.016 to 18.034mm (0.7093 to 0.7100 in)
Service limit.....	18.08 mm (0.712 in)

1100 models

Standard	20.016 to 20.034 mm (0.7880 to 0.7887 in)
Service limit.....	20.08 mm (0.791 in)

Connecting rod crankpin bore ID - 700/750 models

Size group 1	39.000 to 39.008 mm (1.5354 to 1.5357 in)
Size group 2	39.008 to 39.016 mm (1.5357 to 1.5361 in)
Size group 3.....	39.016 to 39.024 mm (1.5361 to 1.5364 in)

Connecting rod crankpin bore ID - 1100 models

Size group 1	43.000 to 43.008 mm (1.6929 to 1.6932 in)
Size group 2.....	43.008 to 43.016 mm (1.6932 to 1.6935 in)

Crankshaft crankpin OD - 700/750 models

Size group A.....	35.992 to 36.000 mm (1.4170 to 1.4173 in)
Size group B.....	35.984 to 35.992 mm (1.4167 to 1.4170 in)
Size group C.....	35.976 to 35.984 mm (1.4164 to 1.4167 in)

Crankshaft crankpin OD -1100 models

Size group A.....	39.992 to 40.000 mm (1.5745 to 1.5748 in)
Size group B.....	39.984 to 39.992 mm (1.5742 to 1.5745 in)

Connecting rod bearing oil clearance (all models)

Standard.....	0.028 to 0.052 mm (0.0011 to 0.0020 in)
Service limit.....	0.08 mm (0.003 in)

Bearing insert thicknesses - 700/750 models

Blue	1.502 to 1.506 mm (0.0591 to 0.0593 in)
Black	1.498 to 1.502 mm (0.0590 to 0.0591 in)
Brown.....	1.494 to 1.498 mm (0.0588 to 0.0590 in)
Green.....	1.490 to 1.494 mm (0.0587 to 0.0588 in)
Yellow.....	1.486 to 1.490 mm (0.0585 to 0.0587 in)

Bearing insert thicknesses -1100 models

Brown.....	1.494 to 1.498 mm (0.0588 to 0.0590 in)
Green	1.490 to 1.494 mm (0.0587 to 0.0588 in)
Yellow.....	1.486 to 1.490 mm (0.0585 to 0.0587 in)

Crankshaft and main bearings

Maximum crankshaft runout.....	0.03 mm (0.001 in)
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Crankcase main bearing bore ID - 700/750 models

Size group A.....	39.000 to 39.008 mm (1.5354 to 1.5357 in)
Size group B.....	39.008 to 39.016 mm (1.5357 to 1.5361 in)
Size group C.....	39.016 to 39.024 mm (1.5361 to 1.5364 in)

Crankcase main bearing bore ID -1100 models

Size group I or 1.....	43.000 to 43.008 mm (1.6929 to 1.6932 in)
Size group II or 2.....	43.008 to 43.016 mm (1.6932 to 1.6935 in)

Crankshaft journal OD - 700/750 models

Size group 1	35.992 to 36.000 mm (1.4170 to 1.4173 in)
Size group 2	35.984 to 35.992 mm (1.4167 to 1.4170 in)
Size group 3.....	35.976 to 35.984 mm (1.4164 to 1.4167 in)

Crankshaft journal OD -1100 models

Size group 1	39.992 to 40.000 mm (1.5745 to 1.5748 in)
Size group 2	39.984 to 39.992 mm (1.5742 to 1.5745 in)

Main bearing oil clearance

Standard.....	0.028 to 0.052 mm (0.0011 to 0.0020 in)
Service limit (all models).....	0.08 mm (0.003 in)

Bearing insert thicknesses - 700/750 models

Blue.....	1.506 to 1.510 mm (0.0593 to 0.0594 in)
Black	1.502 to 1.506 mm (0.0591 to 0.0593 in)
Brown.....	1.498 to 1.502 mm (0.0590 to 0.0591 in)
Green.....	1.494 to 1.498 mm (0.0588 to 0.0590 in)
Yellow.....	1.490 to 1.494 mm (0.0587 to 0.0588 in)

Bearing insert thicknesses -1100 models

Brown.....	1.498 to 1.502 mm (0.0590 to 0.0591 in)
Green.....	1.494 to 1.498 mm (0.0588 to 0.0590 in)
Yellow.....	1.490 to 1.494 mm (0.0587 to 0.0588 in)

Transmission shafts

Ratios

1st.....	2.294 to 1
2nd	
1986 1100 Magna.....	1.667 to 1
All other models.....	1.619 to 1
3rd	
1986 1100 Magna.....	1.286 to 1
All other models.....	1.292 to 1
4th	1.074 to 1
5th	1.897 to 1
6th (overdrive).....	0.750 to 1

Gear backlash (except 1985 through 1988 700/750 Magna models)

1 st gear	
Standard - 700/750 models.....	0.089 to 0.170 mm (0.0035 to 0.0066 in)
Standard -1100 models.....	0.089 to 0.179 mm (0.0035 to 0.0070 in)
Service limit - all models.....	0.24 mm (0.009 in)
2nd, 3rd, 4th, 5th, 6th gears	
Standard	0.068 to 0.136 mm (0.0027 to 0.0054 in)
Service limit.....	0.18 mm (0.007 in)

Gear inner diameter - 700/750 models

M5, M6, C2, C3 gears	
Standard.....	28.000 to 28.021 mm (1.1024 to 1.1032 in)
Service limit.....	28.04 mm (1.104 in)
C1 gear	
Standard -1982 through 1986	24.000 to 24.021 mm (0.9449 to 0.9457 in)
Standard - 1987 through 1988	24.007 to 24.028 mm (0.9451 to 0.9459 in)
Service limit.....	24.04 mm (0.946 in)
C4 gear	
Standard.....	29.000 to 29.021 mm (1.1417 to 1.1426 in)
Service limit.....	29.04 mm (1.143 in)

Gear inner diameter -1100 models

M5, M6, C2, C3, C4 gears	
Standard.....	31.000 to 31.016 mm (1.2205 to 1.2211 in)
Service limit.....	31.18 mm (1.228 in)

Gear bushing outer diameter - 700/750 models

M5, M6, C2, C3 gears	
Standard.....	27.959 to 27.980 mm (1.1007 to 1.1016 in)
Service limit.....	27.94 mm (1.100 in)
C1 gear (except 1987 and 1988 models)	
Standard	23.959 to 23.980 mm (0.9433 to 0.9441 in)
Service limit.....	23.94 mm (0.943 in)
C4 gear	
Standard.....	28.959 to 28.980 mm (1.1401 to 1.1409 in)
Service limit.....	28.94 mm (1.139 in)

Gear bushing outer diameter -1100 models

M5, M6, C2, C3, C4 gears	
Standard.....	30.950 to 30.975 mm (1.2185 to 1.2195 in)
Service limit.....	30.93 mm (1.218 in)

Gear bushing inner diameter - 700/750 models

M5, C4 gears	
Standard	24.985 to 25.006 mm (0.9837 to 0.9845 in)
Service limit.....	25.04 mm (0.986 in)
C1 gear (except 1987 and 1988 models)	
Standard	20.16 to 20.37 mm (0.7937 to 0.8019 in)
Service limit.....	20.40 mm (0.803 in)

Transmission shafts (continued)

Gear bushing inner diameter -1100 models		
M5, C4 gears		
Standard.....	27.995 to 28.016 mm (1.1022 to 1.1030 in)	
Service limit.....	28.05 mm (1.104 in)	
Mainshaft outer diameter at M5 gear - 700/750 models		
Standard.....	24.959 to 24.980 mm (0.9826 to 0.9835 in)	
Service limit.....	24.90 mm (0.980 in)	
Countershaft outer diameter - 700/750 models		
At C1 gear		
Standard	19.98 to 19.993 mm (0.7866 to 0.7871 in)	
Service limit.....	19.93 mm (0.785 in)	
At C4 gear		
Standard	24.959 to 24.980 mm (0.9826 to 0.9835 in)	
Service limit.....	24.90 mm (0.980 in)	
Mainshaft outer diameter at M5 gear and countershaft outer diameter at C4 gear - 1100 models		
Standard.....	27.977 to 27.990 mm (1.1015 to 1.1020 in)	
Service limit.....	27.92 mm (1.099 in)	
Gear to bushing or shaft clearance - 700/750 models		
M5, M6, C1, C2, C3, C4 gears-to-bushing		
Standard	0.020 to 0.062 mm (0.0008 to 0.0024 in)	
Service limit.....	0.10 mm (0.004 in)	
M5, C4 bushings-to-shaft		
Standard	0.005 to 0.047 mm (0.0002 to 0.0019 in)	
Service limit.....	0.06 mm (0.002 in)	
C1 bushing-to-shaft (except 1987 and 1988 models)		
Standard	0.167 to 0.390 mm (0.0066 to 0.0154 in)	
Service limit.....	0.10 mm (0.004 in)	
Gear to bushing or shaft clearance -1100 models		
M5, M6, C2, C3, C4 gears-to-bushing		
Standard	0.025 to 0.066 mm (0.0010 to 0.0026 in)	
Service limit.....	0.10 mm (0.004 in)	
M5, C4 bushings-to-shaft		
Standard	0.005 to 0.039 mm (0.0002 to 0.0015 in)	
Service limit.....	0.05 mm (0.002 in)	
Countershaft spacer clearance (endfloat)		
700/750 models	0.3 to 0.4 mm (0.012 to 0.016 in)	
1100 models.....	0.4 to 0.9 mm (0.016 to 0.035 in)	
Countershaft spacer available thicknesses		
700/750 models except 1985-on Magnas.....	1.0 mm, 1.2 mm, 1.3 mm	
1985 through 1988 700/750 Magnas.....	0.85 mm, 0.90 mm, 0.95 mm, 1.05mm	
1100 models.....	0.85 mm, 0.90 mm, 0.95 mm, 1.0 mm, 1.05 mm	

Shift drum and forks

Shift fork end thickness		
Standard.....	6.43 to 6.50 mm (0.253 to 0.256 in)	
Service limit.....	6.1 mm (0.24 in)	
Shift fork bore ID		
Standard -1982 through 1985 models.....	14.000 to 14.021 mm (0.5511 to 0.5520 in)	
Standard - 1986-on models.....	14.016 to 14.034 mm (0.5518 to 0.5525 in)	
Service limit - all models.....	14.04 mm (0.553 in)	
Shift fork shaft OD		
Standard - 1986-on 700/750 models.....	13.973 to 13.984 mm (0.5501 to 0.5505 in)	
Standard - all other models.....	13.966 to 13.984 mm (0.5498 to 0.5505 in)	
Service limit.....	13.90 mm (0.547 in)	

Torque settings

	Mm	ft-lbs
Valve cover bolts	8 to 12	6 to 9.0
Camshaft sprocket bolts	18 to 20	13 to 14
Cylinder head/cam holder bolts		
6 mm	10 to 14	7 to 10
8 mm	21 to 25	15 to 18
9 mm		
1982 through 1984 700/750 models.....	33 to 37	24 to 27
1985 700 models.....	38 to 42	27 to 30
1986 through 1988 700/750 models.....	43 to 47	31 to 34
10 mm (1100 models).....	48 to 52	35 to 38
Rocker arm shaft bolts or caps.....	45 to 50	33 to 36

Torque settings (continued)	Mm	n-ibs
Clutch center locknut		
1982 750 models.....	47 to 53	34 to 38
1983 through 1985 700/750 Sabres, 1983/84 700/750 Magnas.....	45 to 55	33 to 40
1985 through 1988 700/750 Magnas.....	62 to 68	45 to 49
1100 models.....	63 to 67	46 to 48
Clutch fluid line banjo bolts.....	25 to 35	18 to 25
Oil pump sprocket bolt (1985 through 1988 700/750 Magnas).....	15 to 20	11 to 14
Starter clutch bolt.....	80 to 100	58 to 72
Starter clutch cover bolts.....	26 to 30	19 to 22
Alternator rotor bolt.....	80 to 100	58 to 72
Output gear case bolts		
6 mm bolts.....	10 to 14	7 to 10
Bearing holder bolts.....	30 to 34	22 to 25
8 mm standard/socket bolts.....	21 to 25	14 to 18
Crankcase bolts		
6 mm bolts.....	10 to 14	7 to 10
8 mm bolts.....	21 to 25	15 to 18
9 mm bolts (700/750 models).....	30 to 34	22 to 25
10 mm bolts (1100 models).....	43 to 47	31 to 34
Connecting rod bearing cap nuts.....	30 to 34	22 to 25
Engine oil drain bolt (in oil pan).....	35 to 40	25 to 29
Engine oil drain bolt (in front cylinders).....	10 to 14	7 to 10
Oil pressure switch.....	15 to 20	11 to 14
Engine mounting bolts		
8 mm bolts (1982 through 1986 models).....	20 to 30	14 to 22
8 mm bolts (1987 and 1988 700/750 models).....	24 to 30	17 to 22
10 mm bolts.....	35 to 45	25 to 33
Subframe bolts (US 700/750 Sabres and 1982 through 1984 700/750 Magna models)		
8 mm bolts.....	20 to 30	14 to
22		
10 mm upper bolts.....	70 to 80	51 to 58
10 mm lower bolts.....	30 to 40	22 to 29
Subframe bolts (UK VF750S-C models)		
8 mm bolts.....	20 to 30	14 to 22
10 mm bolts.....	60 to 70	43 to 51
Subframe bolts/nuts (1985 through 1988 700/750 Magna models, all 1100 models)		
Upper bolts.....	60 to 70	43 to 51
Lower bolts.....	35 to 45	25 to 33

General information

Refer to illustration 1.1

The engine is a four-stroke, liquid-cooled type with its four cylinders arranged in a 90° V configuration. This particular design is inherently smoother in its operation than in-line engines because the movement of the pistons in both cylinder banks tends to dampen out the other's vibrations. It also allows the engine to be designed narrower and more compact (**see illustration**).

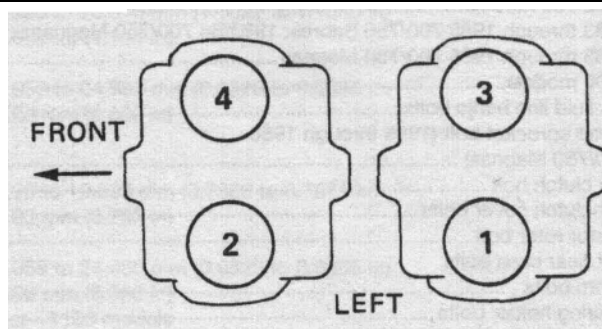
To prevent overheating problems in the rear cylinder bank, the engine is liquid cooled. The coolant is circulated through passages surrounding the cylinder liners and valve area.

Dual overhead cams in each cylinder bank are driven off the crankshaft by link plate chains. The cams ride directly in the cylinder heads and are secured by upper cam holders. There are four valves per cylinder, two intake and two exhaust. Each pair of valves is operated by a single forked rocker arm, requiring only one cam lobe for each pair of valves. Each cam chain is kept tight by a self-adjusting tensioner, located between the cylinders within the loop formed by the chain.

The crankcase splits horizontally, and all four cylinders are integrated with the upper crankcase half in a single casting. The crankshaft rides in four plain main bearings and the firing order is determined by the position of the connecting rods on the crank.

The multi-plate clutch is hydraulically operated using a master cylinder mounted on the handlebars and a slave cylinder on the left side of the engine. All 1100 cc models and the 1983 VF750 Sabre are fitted with a diaphragm spring instead of the coil springs of the other models and also feature a one-way clutch unit. The one-way clutch is essentially a two-piece clutch center with a locking device and prevents rear wheel lockup under severe down shifting or engine braking conditions, by allowing the inner clutch plates to slip.

The 6-speed transmission is a traditional constant-mesh type incorporating an output gear assembly, driven off the countershaft, which transmits drive via the shaft to the rear wheel.



1.1 Cylinder identification

2 Operations possible with the engine in the frame

The components and assemblies listed below can be removed without having to remove the engine/transmission assembly from the frame. If however, a number of areas require attention at the same time, removal of the engine is recommended.

Valve cover, camshafts and rocker arms
Cylinder heads
Cam chain (ens/oners)
Gearshift mechanism external components
Oil pump, relief valve and strainer
Clutch
Starter clutch
Starter motor
Alternator
Water pump

3 Operations requiring engine removal

It is necessary to remove the engine/transmission assembly from the frame, remove the output gear case and separate the crankcase halves to gain access to the following components.

Crankshaft
Main and connecting rod bearings
Pistons and connecting rods
Camshaft drive chains
Transmission shafts/gears
Shift drum/shift forks

4 Major engine repair - general note

1 It is not always easy to determine when or if an engine should be completely overhauled, as a number of factors must be considered.

2 High mileage is not necessarily an indication that an overhaul is needed, while low mileage, on the other hand, does not preclude the need for an overhaul. Frequency of servicing is probably the single most important consideration. An engine that has regular and frequent oil and filter changes, as well as other required maintenance, will most likely give many miles of reliable service. Conversely, a neglected engine, or one which has not been broken in properly, may require an overhaul very early in its life.

3 Exhaust smoke and excessive oil consumption are both indications that piston rings and/or valve guides are in need of attention, although make sure that the fault is not due to oil leakage. Refer to Chapter 1 and perform a cylinder compression check to determine for certain the nature and extent of the work required.

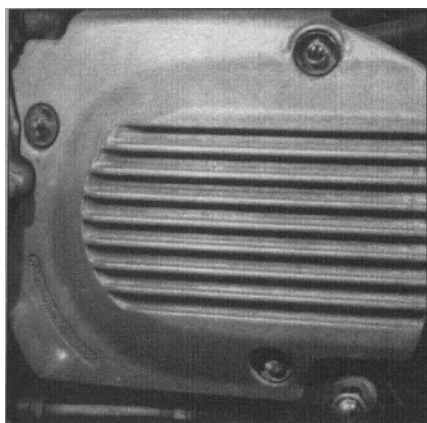
4 If the engine is making obvious knocking or rumbling noises, the connecting rod and/or main bearings are probably at fault.

5 Loss of power, rough running, excessive valve train noise and high fuel consumption rates may also point to the need for an overhaul, especially if they are all present at the same time. If a complete tune-up does not remedy the situation, major mechanical work is the only solution.

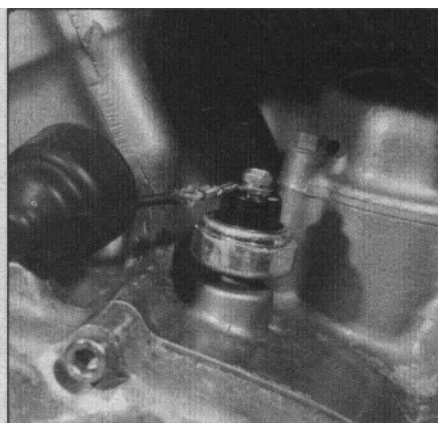
6 An engine overhaul generally involves restoring the internal parts to the specifications of a new engine. During an overhaul the piston rings are replaced and the cylinder walls are bored and/or honed. If a rebore is done, then new pistons will also be required. The main and connecting rod bearings are usually replaced during a major overhaul. Generally the valve seats are serviced as well, since they are usually in less than perfect condition at this point. While the engine is being overhauled, other components such as the carburetors and the starter motor can also be rebuilt. The end result should be a like new engine that will give as many trouble-free miles as the original.

7 Before beginning the engine overhaul, read through the related procedures to familiarize yourself with the scope and requirements of the job. Overhauling an engine is not all that difficult, but it is time consuming. Plan on the motorcycle being tied up for a minimum of two weeks. Check on the availability of parts and make sure that any necessary special tools, equipment and supplies are obtained in advance.

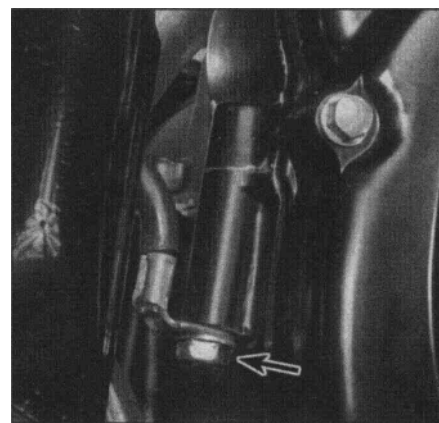
8 Most work can be done with typical shop hand tools, although a number of precision measuring tools are required for inspecting parts to determine if they must be replaced. Often a dealer service department or motorcycle repair shop will handle the inspection of parts and offer advice concerning reconditioning and replacement. As a general rule, time is the primary cost of an overhaul so it does not pay to install worn or substandard parts.



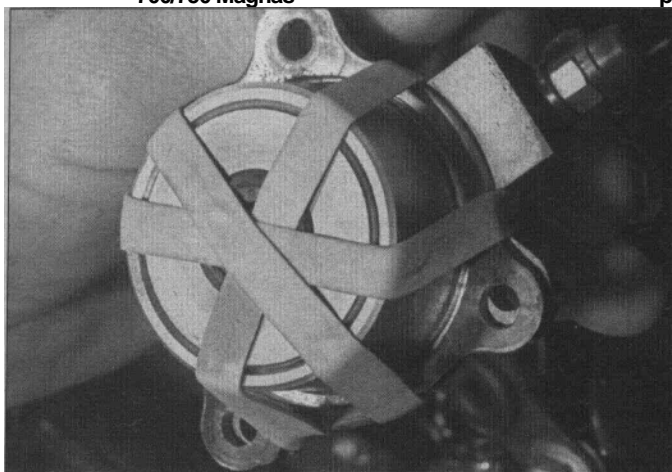
5.5 Engine left side rear cover is retained by three bolts on 1100 models and later 700/750 Magnas



5.15 Peel back its rubber cover and disconnect the wire from the oil pressure switch



5.16 Battery ground (earth) cable connection



5.17 Retain clutch slave cylinder piston with strong rubber bands

9 As a final note, to ensure maximum life and minimum trouble from a rebuilt engine, everything must be assembled with care in a spotlessly clean environment.

5 Engine - removal and installation

Note: Engine removal and installation should be carried out with the aid of an assistant; personal injury or damage could occur if the engine falls or is dropped. An hydraulic floor-type jack should be used to support and lower the engine to the floor if possible (they can be rented at low cost).

Removal

Refer to illustrations 5.5, 5.15, 5.16, 5.17, 5.21, 5.22, 5.23a, 5.23b and 5.23c

1 Place the motorcycle on the main stand. On 1987 and 1988 700/750 Magnas (without a main stand), first remove the belly fairing (see Chapter 6), then support the machine with an auxiliary motorcycle stand to ensure it will not topple when the engine unit is removed.

2 Remove the seat (see Chapter 6) and main fuel tank (see Chapter 4).

3 Remove both the left and right side covers (see Chapter 6). Disconnect the negative battery lead.

4 Drain the engine oil (see Chapter 1).

5 Remove the engine left rear cover; it is retained by a single bolt on

all 700/750 Sabre models and 1982 through 1984 700/750 Magna models (note the long collar inside the cover) and by three bolts on all 1100 models and 1985-on 700/750 Magna models (**see illustration**). Remove the gearshift lever and linkage (see Section 18).

6 Drain the coolant (see Chapter 1), then remove the water hose that runs between the water pump and subframe.

7 Remove the radiator (see Chapter 3).

8 Remove the exhaust pipes (see Chapter 4). **Note:** The two rear head pipes need not be removed.

9 Remove the air filter housing(s) and carburetors (see Chapter 4).

10 On 1984-on California models, detach the emission control system canister from the front lower frame brace.

11 On 1986 California models, detach the secondary air supply system reed valve blocks from each side of the rear cylinder bank. On 1986 through 1988 700/750 California models, detach the secondary air supply system air suction valve from the front of the oil pan.

12 Remove the thermostat and its housing (see Chapter 3).

13 Disconnect the crankcase breather tube from the air chamber/air filter housing, then disconnect its lower end from the rear of the crankcase.

14 On 1987 and 1988 700/750 Magna models, release the rear brake switch from its bracket on the engine right cover (see Chapter 8).

15 Pull the spark plug caps off the spark plugs and tie them to the frame top tubes. Disconnect the wiring harness that leads to the following components:

- a) Oil pressure switch (**see illustration**).
- b) Pulse generators.
- c) Alternator.
- d) Starter motor.
- e) Gearchange switch or neutral/OD switch (as applicable).

16 Disconnect the battery ground (earth) cable where it attaches to the engine, directly in front of the right swingarm pivot (**see illustration**).

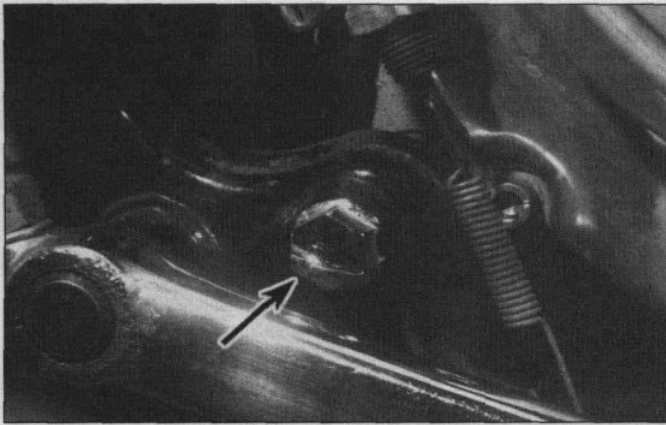
17 Without disconnecting the clutch fluid line, remove the clutch slave cylinder from the engine. Once removed, the clutch lever should not be applied. To ensure this, place a wooden block between the lever and the handlebar grip and tie the lever tight to the block. Also, wrap strong rubber bands around the slave cylinder housing and piston to make sure the piston does not come out (**see illustration**).

18 Remove the rear wheel and disconnect the driveshaft from the gearcase (see Chapter 6).

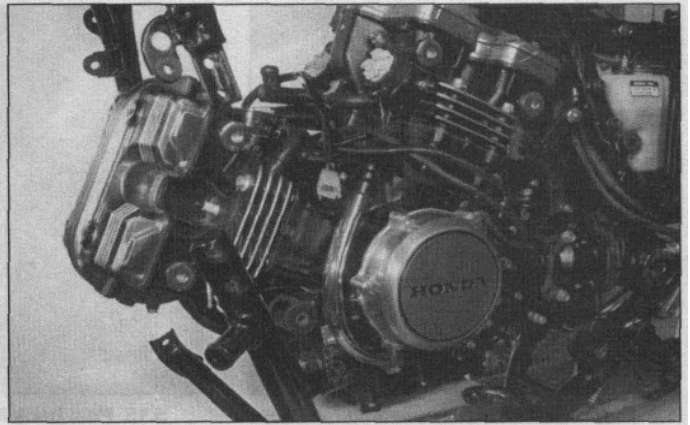
19 Position a jack under the engine oil pan; this will be used to support the engine once the mounting bolts have been removed.

Note: A piece of wood should be used between the jack and the oil pan to protect it and give a better grip.

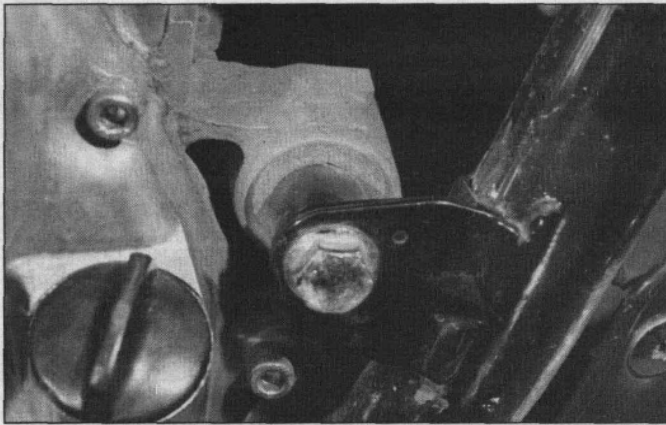
20 Remove the left footpeg (see Chapter 6). On 1100 Sabre models, also remove the rear brake pedal from its shaft.



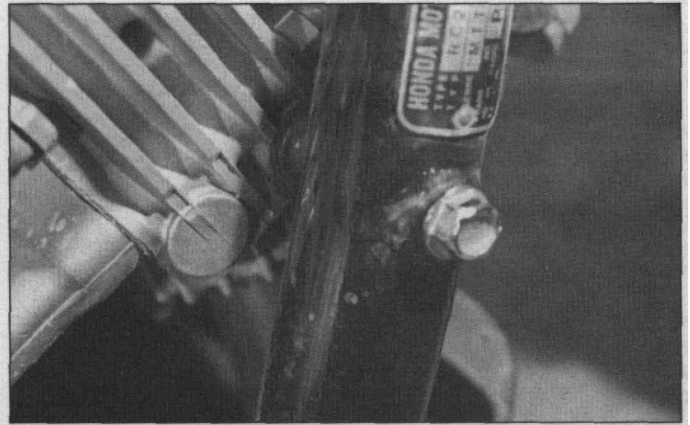
5.21 Engine rear lower throughbolt (arrow) - threaded stud and nuts on some models



5.22 Removing the subframe



5.23a Engine front mounting on right side



5.23b Front cylinder steady bolt on right side (later models)

21 Remove the engine rear lower throughbolt or threaded stud and nuts (as applicable) (**see illustration**).

22 Remove the subframe-to-engine mounting bolt on the left side and then remove the subframe-to-main frame mounting bolts and remove the subframe (**see illustration**).

23 Raise the jack just enough to take the weight off the remaining engine mounting bolts and then remove them (**see illustrations**).

Note: You should have an assistant on hand to help you balance the engine on the jack while these last two mounting bolts are removed. Take note of the position of all collars, wire clamps and washers so that they can be returned to their original positions on installation.

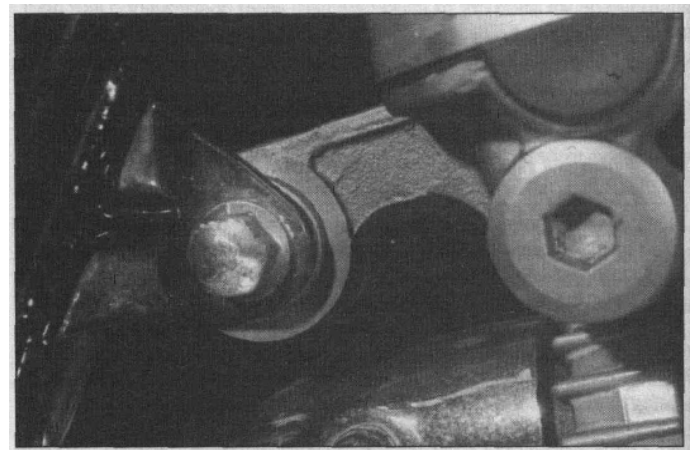
24 The engine can now be lowered on the jack and removed from the left side of the frame. **Note:** Lower the jack slowly and carefully and check all clearances as the engine is lowered. The engine may have to be pivoted slightly on the jack to clear the frame tubes.

25 Remove any engine mount rubbers or bushings. Inspect them for wear or damage and replace them if necessary.

Installation

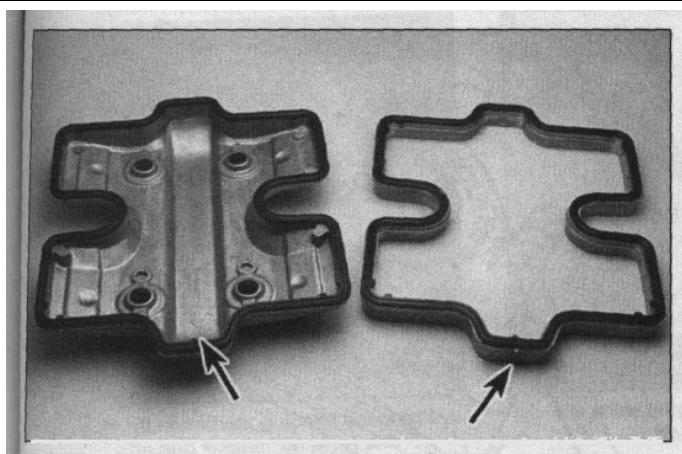
26 Installation of the engine is essentially the reverse of the removal procedure, with the following notes:

- When installing the engine in the frame, use the jack to align the mounting bolt holes to prevent damage to the bolt threads. Install all engine mounting bolts loosely until the subframe bolts are tightened. Then tighten all engine mounting bolts to their proper torque.
- When installing components, be sure to refer to the appropriate Section or Chapter for the proper installation procedure.



5.23c Engine rear upper throughbolt

- Following installation, fill the crankcase with the proper amount and grade of oil (**see Chapter 1**).
- Fill the cooling system with fresh coolant and bleed it of air (**see Chapter 1**).
- Adjust the throttle cables and idle speed (**see Chapter 1**).
- Set the choke cable freeplay (**see Chapter 4**).



7.7 Install valve covers with arrow mark facing forwards. Tab on rear cover base must also face forwards

6 Engine disassembly and reassembly - general information

Note: Refer to the 'Maintenance techniques, tools and working facilities' in the Introductory pages of this manual for further information.

Disassembly

Before disassembling the engine, the external surfaces of the unit should be thoroughly cleaned and degreased. This will prevent contamination of the engine internals, and will also make working a lot easier and cleaner. A high flash-point solvent, such as kerosene (paraffin) can be used, or better still, a proprietary engine degreaser. Use old paintbrushes and toothbrushes to work the solvent into the various recesses of the engine casings. Take care to exclude solvent or water from the electrical components and intake and exhaust ports. **Warning:** The use of gasoline (petrol) as a cleaning agent should be avoided because of the risk of fire.

2 When clean and dry, arrange the unit on the workbench, leaving a suitable clear area for working. Gather a selection of small containers and plastic bags so that parts can be grouped together in an easily identifiable manner. Some paper and a pen should be on hand to permit notes to be made and labels attached where necessary. A supply of clean shop towels is also required.

3 Before commencing work, read through the appropriate section so that some idea of the necessary procedure can be gained. When removing various engine components it should be noted that great force is seldom required, unless specified. In many cases, a component's reluctance to be removed is indicative of an incorrect approach or removal method. If in any doubt, re-check with the text.

4 When disassembling the engine, keep "mated" parts together (including gears, cylinders, pistons, valves, etc. that have been in contact with each other during engine operation). These 'mated' parts must be re-used or replaced as an assembly.

5 Engine/transmission disassembly should be done in the following general order with reference to the appropriate Sections.

- Remove the valve covers (see Section 7)
- Remove the camchain tensioners (see Section 8)
- Remove the camshafts (see Section 9)
- Remove the cylinder heads (see Section 10)
- Remove the starter motor (see Chapter 8)
- Remove the ignition pulse generators (see Chapter 5)
- Remove the starter clutch (see Section 13)
- Remove the clutch (see Section 14)
- Remove the external gearshift components (see Section 17)
- Remove the alternator rotor and stator (see Section 19)
- Remove the water pump (see Chapters)

- Remove the oil pan and oil pump (see Sections 20 and 21)
- Remove the output gear case (see Section 23)
- Separate the crankcases (see Section 24)
- Remove the crankshaft (see Section 28)
- Remove the pistons and connecting rods (see Section 29)
- Remove the transmission shafts (see Section 31)
- Remove the shift drum and forks (see Section 32)

Reassembly

6 Reassembly is accomplished by reversing the general disassembly sequence.

7 Valve covers - removal and installation

Note: The valve covers can be removed with the engine in the frame. If the engine has been removed, ignore the steps which do not apply.

Removal

- 1 Place the motorcycle its stand, then remove the seat and both side covers.
- 2 Remove the fuel tank (see Chapter 4).
- 3 Drain the coolant and remove the radiator as described in Chapter 3. This is necessary to gain access to the front cylinder valve cover. **Note:** The coolant can be re-used if it is drained into a clean container.
- 4 On models where the ignition HT coils are mounted across the frame top tubes, and therefore prevent access to the rear cylinder, remove them and the plastic heat shield (see Chapter 5). Also release any wiring ties to improve access to the valve covers.
- 5 Remove all four spark plugs.
- 6 Remove all valve cover bolts from both cylinder banks and lift off both of the valve covers, plus the valve cover base from the rear cylinder.

Installation

Refer to illustration 7.7

- 7 Make sure the gasket surfaces of the cylinder head and the valve covers are clean. If the valve cover seal is damaged in any way replace it. Apply a smear of sealant to the cover seal and on 1987 and 1988 700/750 Magna models also to the half circle projections, then carefully install the covers. The valve covers should be installed with the cast arrow marks on the inside of the covers facing forward. Also, the cover base for the rear valve cover should be installed with the mark and the tab on the gasket to the front (see illustration).
- 8 Install the spark plugs, plastic heat shield, HT coils, wiring harness ties, radiator, fuel tank, side covers and seat.
- 9 Refill and bleed the cooling system as described in Chapter 1.
- 10 Start the engine and check that there are no oil leaks around the valve covers.

8 Camchain tensioner and guides - removal and installation

Note: The camchain tensioner and guides can be removed with the engine in the frame.

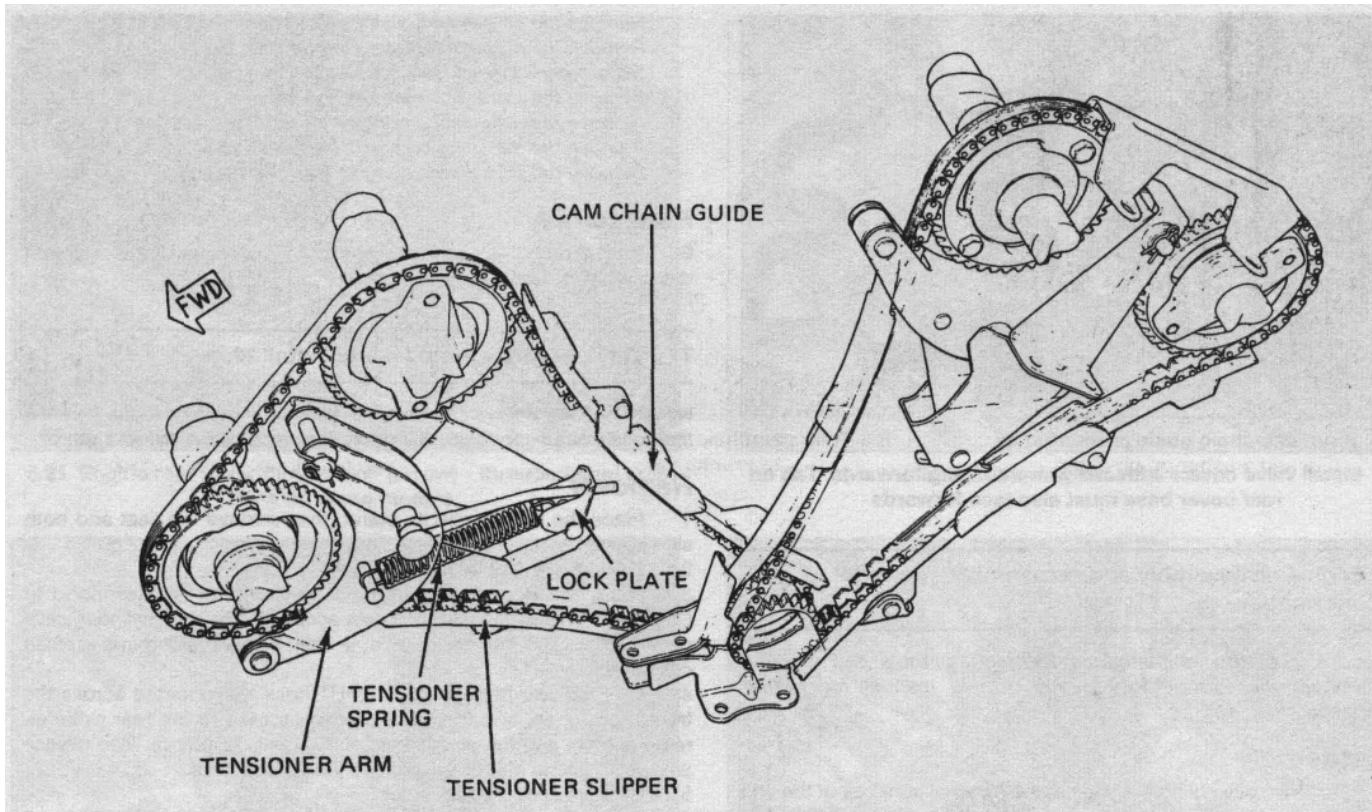
Note: Be especially careful not to drop any parts into the crankcase. The minimal amount of work necessary to retrieve dropped parts will be removal of the oil pan and at worst separation of the crankcases.

Removal

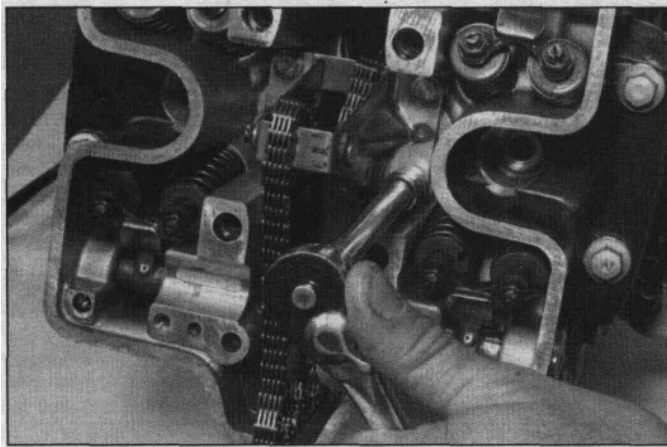
Cam chain tensioners and slippers

Refer to illustrations 8.2a, 8.2b and 8.2c

- 1 Follow Steps 1 to 14 of Section 9 to remove the camshafts.
- 2 Remove the cam chain tensioner base bolts and pull the tensioner base up. Then remove the clip and clevis pin that attaches the



8.2a Camchain and tensioner assembly



8.2b Remove tensioner base bolts to free it from the head ... tensioner arm to the slipper (see illustrations). Lift out the base, complete with tensioner arm.

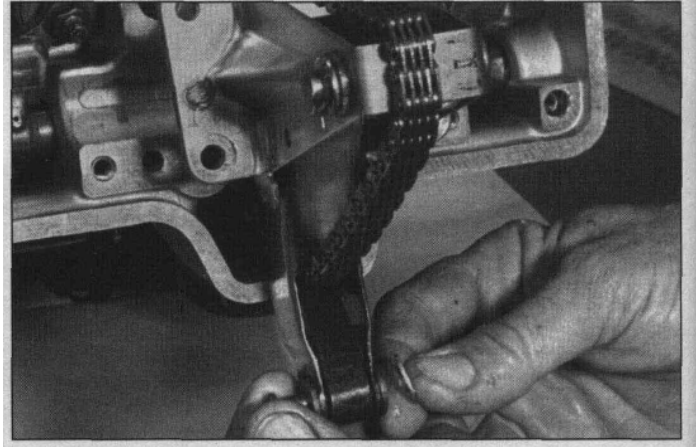
3 Gently pull the slipper out of its support in the crankcase.

Cam chain guides and slipper supports

Refer to illustrations 8.5, 8.6 and 8.7

4 Remove the cylinder heads (see Section 10).

5 The front cylinder bank chain guide is slipped over a pivot pin on the cavity wall and secured with a wire clip (see illustration). Insert a hooked piece of wire through the clip to keep it from falling and then push the clip out from the other side using a screwdriver. Carefully reach in and remove the washer from the pivot pin. Remove the guide from the pivot pin and lift it out.



8.2c ... then release slipper from tensioner arm

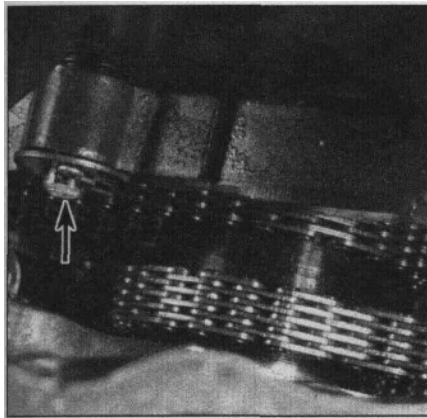
6 The rear cylinder bank chain guide is held by two mounting bolts. Slowly unscrew the bolts while lifting up on the guide to keep tension on the bolts. When the bolts are completely unscrewed, carefully lift the guide, with bolts, out of the cylinder cavity (see illustration).

7 The slipper support holders are also located in the crankcase cavity. Carefully loosen their mounting bolts until they are completely unscrewed, then use needle-nose pliers to pick the bolts and supports out (see illustration).

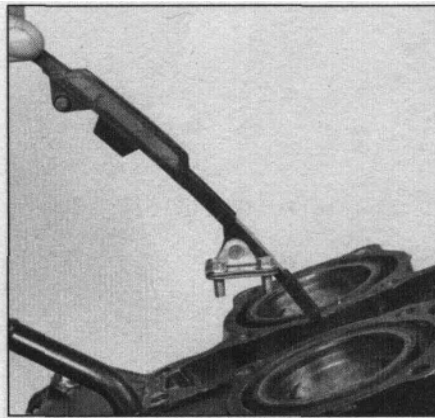
Installation

Cam chain guides and slipper supports

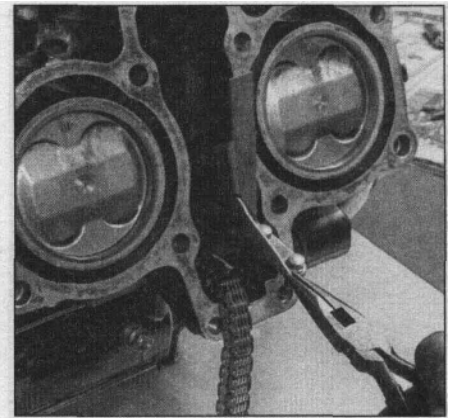
8 Apply thread locking agent to the slipper support holder bolts and insert them into the holder. Use needle-nose pliers to install the holder



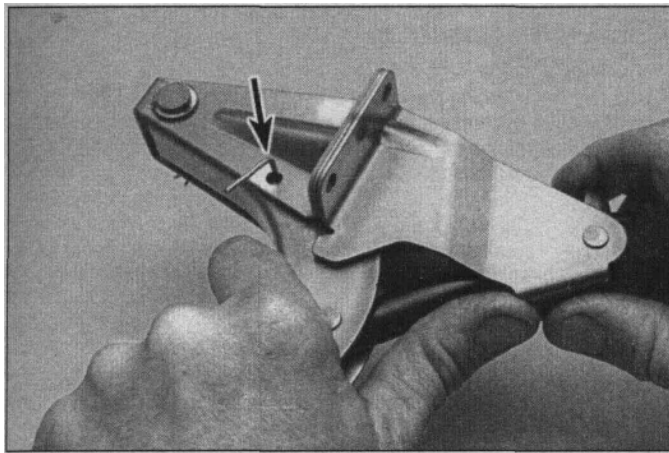
8.5 Front camchain guide is secured by clip and washer on pivot pin



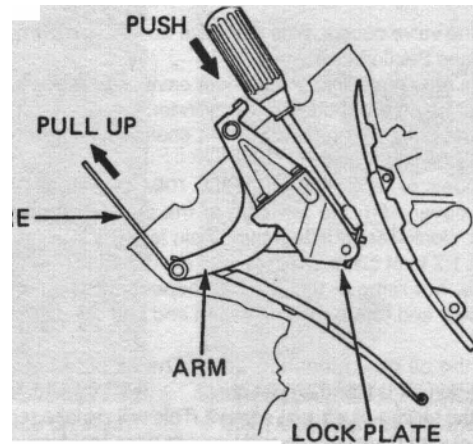
8.6 Rear camchain guide is bolted to crankcase



8.7 Pick slipper support holders out of crankcase once their bolts have been removed



8.13 Camchain tensioner locked in the Off position



8.16 Method of unlocking camchain tensioner

into place in the crankcase cavity. The bolts are most easily tightened using a socket with a swivel joint, while keeping the holder raised slightly to prevent the bolts from falling out.

9 Install the front cylinder bank chain guide onto the pivot pin. Carefully slip the washer over the pin. Then, again with a piece of hooked wire inserted through the clip, lower it into the cavity, set it in its hole and push it through with a screwdriver. Disconnect the wire from the clip.

10 Apply thread locking agent to the rear cylinder bank guide bolts and insert them into place on the guide. Then carefully lower the guide into place in the cavity. Tighten the bolts while keeping the guide raised slightly to prevent them from dropping out.

11 Install the cylinder heads.

Cam chain tensioners and slippers

Refer to illustrations 8.13 and 8.16

12 Insert the slipper's rounded end into the slipper holder in the crankcase. **Caution:** The slipper end must be slotted into the holder (use a hand-held flashlight to check this) otherwise it will not be properly secured and engine damage will result.

13 The cam chain tensioner should be locked to keep tension off the chain during installation of the camshafts and subsequent valve timing. A plate at the bottom of the tensioner rod locks the rod in place. Release this plate so the tensioner arm can be raised enough to insert a lock pin or piece of wire through the aligned holes in the arm and base (**see illustration**). This will keep the tensioner locked in the off position.

14 Place the tensioner base into position in the cylinder head and thread the chain over it. Do not install the tensioner base bolts yet. Attach the slipper to the tensioner with the clevis pin and clip.

15 Refit the camshafts and oil pipe (see Section 9).

16 Unlock the tensioner by holding pressure on the tensioner lock plate with a screwdriver, then pull up on the tensioner arm and remove the lock pin or piece of wire (**see illustration**). Slowly let the arm pull itself back into the cavity. After unlocking the tensioner, install and tighten the tensioner base bolts. Install the tensioner top guide.

17 Remove any rags from the cylinder head and install all components in a reverse of the removal procedure. Check the oil level and top up if necessary and set the valve clearances (see Chapter 1). Top up the coolant (see Chapter 1).

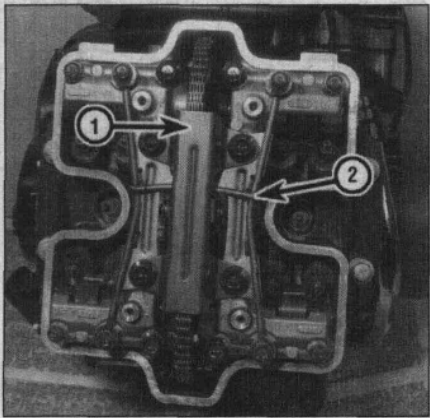
9 Camshaft and rocker arms - removal, inspection and installation

Note: This procedure can be carried out with the engine in the frame. If the engine has been removed, ignore the steps which don't apply.

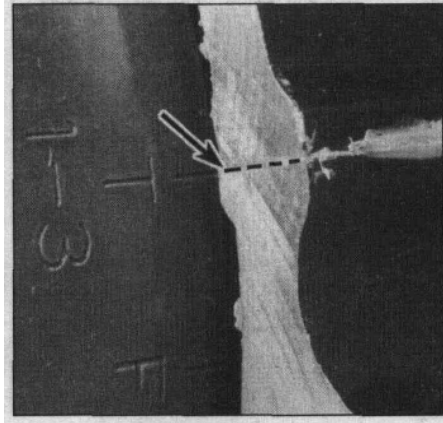
Camshaft removal

Refer to illustrations 9.4, 9.8a and 9.8b

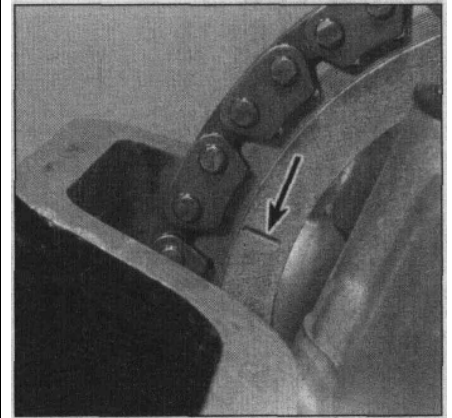
1 Drain the engine oil from the front cylinder head by removing the front cylinder bank drain bolt (see Chapter 1 'Engine oil and filter change').



9.4 Camchain tensioner guide (1) is retained by four bolts. Note oil pipe (2)



9.8a With alternator T1.3 mark aligned with crankcase mating surface (all except 1987/88 models)...



9.8b ... both cam sprocket alignment marks should align with head surface

2 Remove the valve covers, plus the valve cover base from the rear cylinder bank (see Section 7).

3 Stuff clean rags down into the cylinder cavities to prevent bolts or other parts from being dropped into the cylinder.

4 Remove the bolts that retain the cam chain tensioner guide and lift the guide out (see illustration).

5 On all models except 1987 and 1988 700/750 Magnas, remove the alternator cover from the left side of the engine and rotate the alternator rotor clockwise until the cam chain is at its loosest point; it will have about 1/2 in of slack. Do the same on 1987 and 1988 700/750 Magna models, but remove the circular inspection cover set in the engine right cover and rotate the crankshaft end bolt counterclockwise (anticlockwise).

6 Remove the oil pipe mounting bolts. The oil pipe can now be removed by passing it under the cam chain.

7 Back off the valve adjustment screws. This will release tension on the camshafts during disassembly and prevent possible damage to the cam holders.

8 On all except 1987 and 1988 700/750 Magna models, rotate the alternator rotor until the T1.3 mark is aligned with the rear crankcase mating surface. On 1987 and 1988 700/750 Magna models, rotate the starter clutch bolt until the T1.3 mark aligns with the punch mark on the inspection cover aperture. In this position, the index marks on the camshaft sprockets should be in alignment with the top surface of the cylinder heads (see illustrations).

Note: On early engines (circa 1982/83) the valve timing index marks were incorrectly marked on the front cylinder camshaft sprockets. It is recommended that you check the accuracy of these marks at this stage; if they do not exist, mark the sprockets level with the cylinder head surface using a fine-tipped felt marker to serve as a guide to reassembly.

9 Remove the exposed cam sprocket mounting bolts. Then rotate the engine one complete turn until the T1.3 mark is again aligned and remove the other cam sprocket bolts. **Note:** Take care that the cam chain in the opposite cylinder does not bind while rotating the crankshaft.

10 Lift the cam sprockets off the camshaft shoulders and disengage the camchain from them.

11 Before removing the cam holders, mark their top surfaces with a felt marker pen for identification (eg, 1E to denote cylinder no. 1 exhaust cam holder).

12 Loosen the cam holder bolts evenly in a criss-cross sequence to prevent distortion, then lift off the holders. Retrieve the dowels if they are loose - on later models they are pressed into the holders.

13 Lift the camshafts out and remove the sprockets from them. Support the camchain over the tensioner.

14 Clean all of the parts with solvent and dry them thoroughly.

Camshaft inspection

Refer to illustrations 9.15, 9.16, 9.17, 9.21 a, 9.21 b, 9.23 and 9.24 **Note:** Before replacing the camshafts or the cylinder head and bearing caps because of damage, check with local machine shops specializing in motorcycle engineering work. In the case of the camshafts, it may be possible for cam lobes to be welded, reground and hardened, at a cost far lower than that of a new camshaft. If the bearing surfaces in the cylinder head are damaged, it may be possible for them to be bored out to accept bearing inserts. Due to the cost of a new cylinder head it is recommended that all options be explored before condemning it as trash!

15 Inspect the cam bearing surfaces of the head and the bearing caps. Look for score marks, deep scratches and evidence of spalling (a pitted appearance). Check the camshaft lobes for heat discoloration (blue appearance), score marks, chipped areas, flat spots and spalling (see illustration).

16 Camshaft runout can be checked by supporting each end of the camshaft on V-blocks, and measuring any runout using a dial gauge (see illustration). If the runout exceeds the specified limit the camshaft must be replaced.

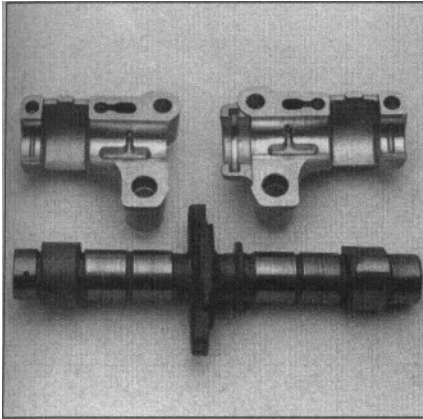
17 Measure the height of each lobe with a micrometer (see illustration) and compare the results to the lobe height service limit listed in this Chapter's Specifications. If damage is noted or wear is excessive, the camshaft must be replaced.

18 The camshaft bearing oil clearance is checked either by a product known as Plastigage or by direct measurement, depending on the model being worked on. If working on a 1986 through 1988 700/750 Magna model check by direct measurement (see Steps 19 and 24), and on all other models check using Plastigage (see Steps 20 through 24).

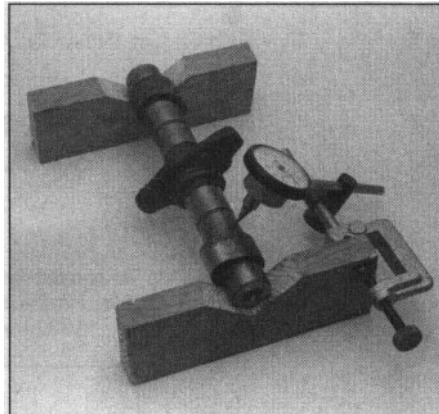
19 To check by direct measurement you will need a small hole gauge type micrometer. Fit the bearing holders to the head in their correct positions (do not install the camshafts). Tighten the retaining bolts to the specified torque in a criss-cross pattern. Measure the internal diameter of each bearing cap journal and compare the measurements obtained with the service limit given in the Specifications at the start of this Chapter. If any bore is worn beyond the service limit, the cylinder head and bearing holders must be repaired/replaced. The camshaft bearing oil clearance can then be calculated by subtracting the camshaft bearing journal diameter from the bearing cap journal diameter (see Step 24).

20 If using Plastigage first clean the camshafts, the bearing surfaces in the cylinder head and the bearing holders with a clean, lint-free cloth, then lay the camshafts in place in the cylinder head.

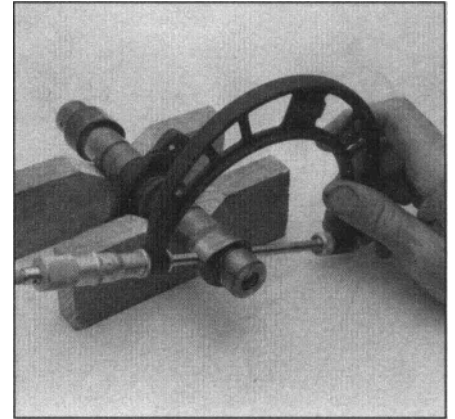
21 Cut strips of Plastigage and lay one piece on each bearing journal, parallel with the camshaft centerline. Make sure the dowels are installed in the cam holders and fit them in their proper positions;



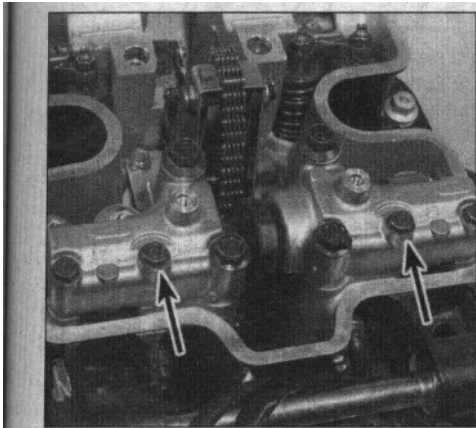
9.15 Check the cam bearing surfaces and camshaft for wear or damage



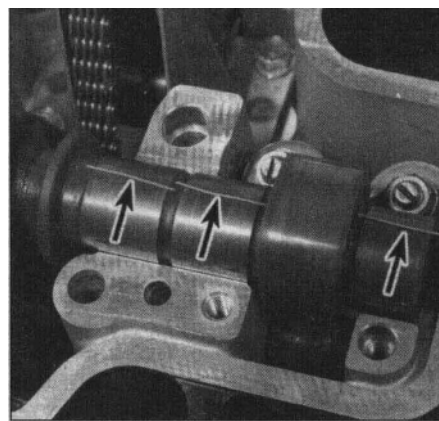
9.16 Measuring camshaft runout



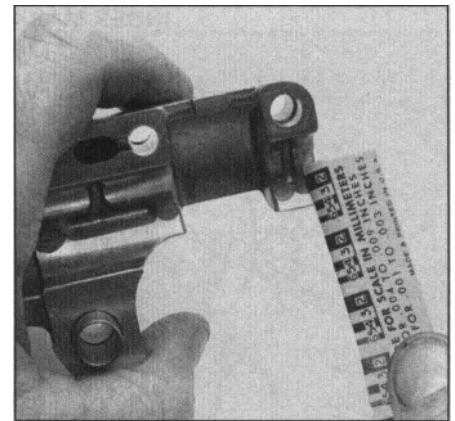
9.17 Measuring camshaft lobe height



9.21a Use shorter 6 mm bolts (arrows) in place of the oil pipe bolts when checking bearing oil clearance



9.21b Lay a strip of Plastigage on each camshaft journal



9.23 Measure the crushed Plastigage against the scale on the envelope

substitute shorter 6 mm bolts in place of the oil pipe mounting bolts when measuring the oil clearance (**see illustrations**). Ensuring the camshafts are not rotated at all, tighten the cam holder bolts to the specified torque in a criss-cross pattern.

22 Now unscrew the bolts in a criss-cross pattern and carefully lift off the cam holders, again making sure the camshafts are not rotated.

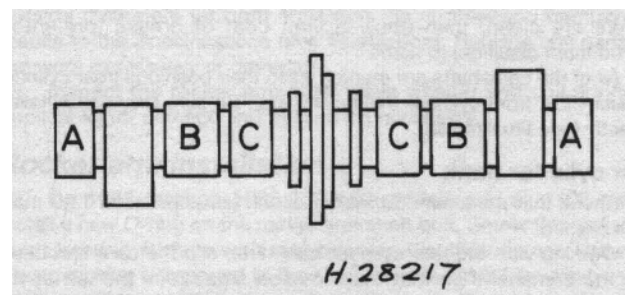
23 To determine the oil clearance, compare the crushed Plastigage (at its widest point) on each journal to the scale printed on the Plastigage container (**see illustration**).

24 Compare the results to this Chapter's Specifications. If the oil clearance is greater than specified, measure the diameter of the camshaft bearing journal with a micrometer (**see illustration**). If the journal diameter is less than the specified limit, replace the camshaft with a new one and recheck the clearance. If the clearance is still too great, replace the cylinder head and cam holders with new parts (see the Note at the start of this sub-Section). On early models the manufacturer does not specify a figure for camshaft journal wear; if the oil clearance is too great the camshafts must be replaced, and if still too great the cylinder head and cam holders must also be replaced.

25 Except in cases of oil starvation, the camchain wears very little. If the camchain has stretched excessively, which makes it difficult to maintain proper tension, remove and measure it as described in Section 26.

26 Check the sprockets for wear, cracks and other damage, replacing them if necessary. If the sprockets are worn, the camchain is also worn, and also the sprocket on the crankshaft. If wear this severe is apparent the camchain and all sprockets should be replaced.

27 Refer to Section 26 and examine the camchain guides for wear.



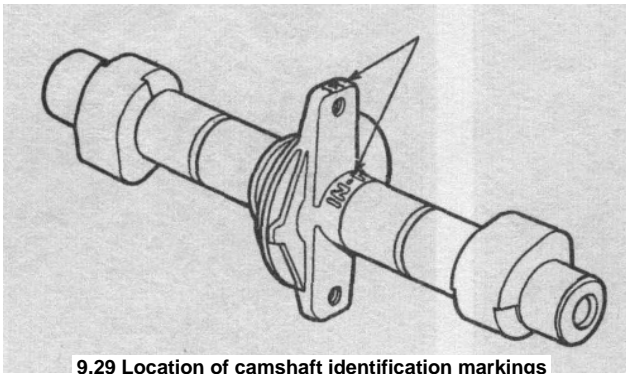
9.24 Camshaft journal identification for diameter measurement • 1986 through 1988 700/750 Magna models

- A Outer journal (see Specifications)
B Center journal C Inner journal (nearest sprocket)

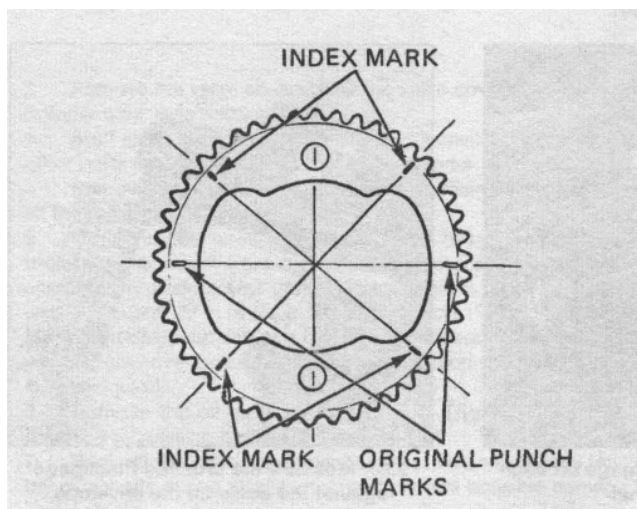
Camshaft installation

Refer to illustrations 9.29, 9.32, 9.36 and 9.38

Note: If there is insufficient slack in the camchain to allow the sprockets to be mounted on the camshafts, refer to Section 8 and lock the tensioner in position.



9.29 Location of camshaft identification markings



9.36 New front cylinder camshaft sprocket index marks (1982/83 models)

28 Make sure the bearing surfaces in the cylinder head and cam holders are clean, then apply a light coat of grease (preferably molybdenum disulfide) to them.

29 All of the camshafts are marked as to their positions (rear cylinder exhaust - ER, front cylinder intake - IF, etc). Be sure they are installed correctly (see illustration).

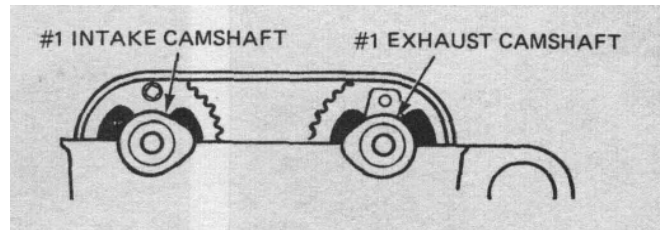
Rear cylinder bank

30 Check that the alternator/starter clutch (as applicable) T1.3 mark is still aligned.

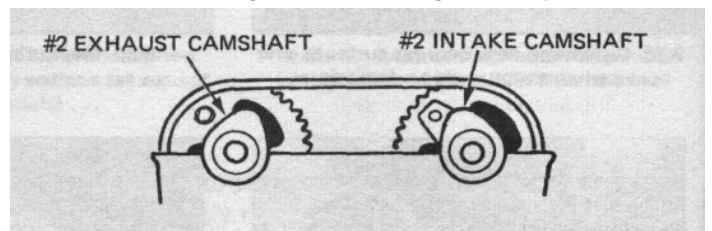
31 Working with the rear cylinder bank first, slip the cam sprockets onto the camshafts so that their marked sides face the left of the engine. The inlet camshaft sprocket should be on the left side of its camshaft boss, and the exhaust sprocket on the right side of its camshaft boss.

32 Carefully pass the camshafts through the camchain and into position in the cylinder head bearing surfaces. On all 700/750 Sabres and 1982 through 1984 700/750 Magnas they should be positioned so the number 1 cylinder's lobes are parallel with the head surface and facing each other (see illustration). On all other models, position the camshafts so that their identification markings (see illustration 9.29) are facing upwards. Position the cam sprockets so their index marks are in line with the head surface and place the camchain onto the sprockets.

33 Place the cam holders into position (using the notes made on



9.32 Rear cylinder bank camshaft installation positions as seen from No. 1 cylinder side (1982 through 1985 700/750 Sabre and 1982 through 1984 700/750 Magna models)



9.38 Front cylinder bank camshaft installation positions as seen from No 2 cylinder side (1982 through 1985 700/750 Sabre and 1982 through 1984 700/750 Magna models)

removal) and loosely install the bolts, noting their correct position (see illustration 10.22).

34 Place the cam sprockets onto the camshaft flanges and install the mounting bolts in the exposed holes finger-tight. Carefully rotate the engine making sure the camchain in the other cylinder bank doesn't bunch up, and install the other sprocket bolts finger-tight.

Front cylinder bank

35 Rotate the engine until the T2.4 mark is aligned with the casing mark.

36 If on early models (circa 1982/83), index marks were neither found nor made on the front cylinder sprockets on removal, this must be done at this stage. These marks are made six teeth (or at a 45° angle) from the original indented index marks, using a scribe or permanent ink marker (see illustration).

37 Install the sprockets onto the camshafts so that their marked side faces the left of the engine and pass the camshafts through the chain into place in their cylinder head bearing surfaces. The inlet camshaft sprocket should be on the right side of its camshaft boss, and the exhaust sprocket on the left side of its camshaft boss.

38 On all 700/750 Sabres and 1982 through 1984 700/750 Magnas the lobes for cylinder no. 2 should be positioned as shown (see illustration). On all other models the camshaft identification markings must be facing upwards. The sprocket index marks should align with the head surface on all models.

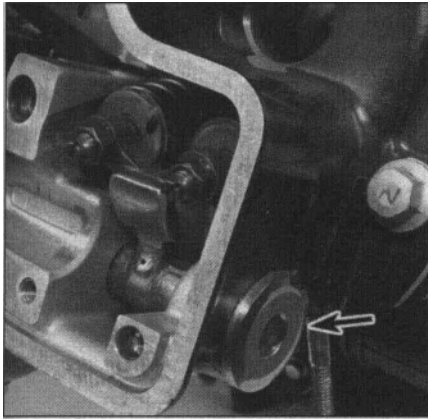
39 Position the camchain on the sprockets. On 1985 through 1988 700/750 Magna models, Honda specify that there should be a total of 46 camchain link pins between the sprocket index marks when correctly positioned.

40 Place the cam holders into position (using the notes made on removal) and loosely install the bolts, noting their correct location (see illustration 10.22).

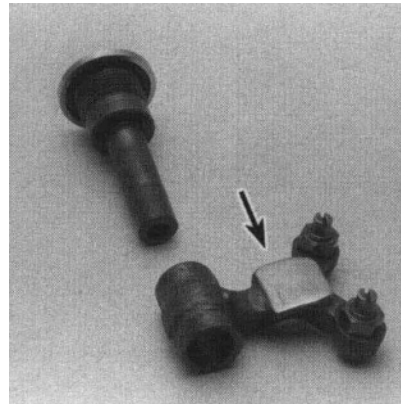
41 Place the cam sprockets onto the camshaft flanges and install the mounting bolts in the exposed holes finger-tight. Rotate the engine and install the other sprocket bolts finger-tight.

Both cylinder banks

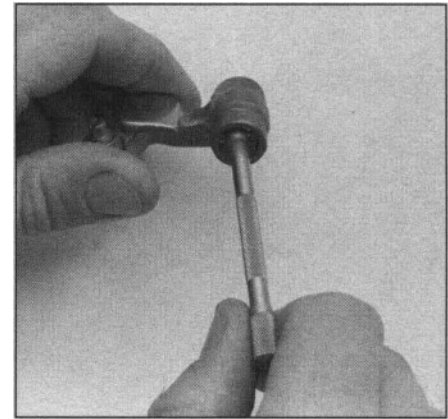
42 Make a final check that the sprocket and cam lobe positions are correct (see Steps 32, 37 and 38). If only one cylinder bank was



9.53 Rocker shaft is unscrewed from side of head on 1982 through 1985 700/750 models and all 1100 models



9.56a Inspect the cam lobe contact surface of the rocker arms for wear



9.56b Measure the rocker arm inside diameter...

worked on, remove the valve cover from the other cylinder bank and check that the valve timing marks align as specified above.

43 Remove each sprocket bolt in turn, apply thread-locking compound to its threads and tighten to the specified torque.

44 Rotate the engine until the camchain is at its loosest point and slip the oil pipe under the chain and into position. Install the oil pipe mounting bolts. Install the oil pipe in the other cylinder in the same manner.

45 Tighten the cam holder bolts evenly in two or three stages until the specified torque is reached; refer to the cylinder head/cam holder tightening sequence in illustration 10.22.

46 If the camchain tensioner was locked during installation of the chain, refer to Section 8 and release it. **Note:** Make a check (using a hand-held flashlight) that the bottom end of the tensioner slipper blade has remained in its holder socket - if it has popped out engine damage will result. Install the camchain tensioner guide.

47 Remove the rags from the cylinders.

48 Adjust the valve clearances and install the valve covers and rear valve cover base as described in Chapter 1.

49 Refit all disturbed components in a reverse of the removal procedure.

50 Refill and bleed the cooling system as described in Chapter 1.

51 Top up the engine oil (see Chapter 1).

Rocker arm removal

Refer to illustration 9.53

52 Remove the camshafts, as described in Steps 1 to 13.

53 On 1982 through 1985 700/750 models and all 1100 models, remove the rocker arm shaft bolt (**see illustration**). Lift the rocker arm out of the cylinder head. Remove the wave washer and O-ring from the shaft bolt.

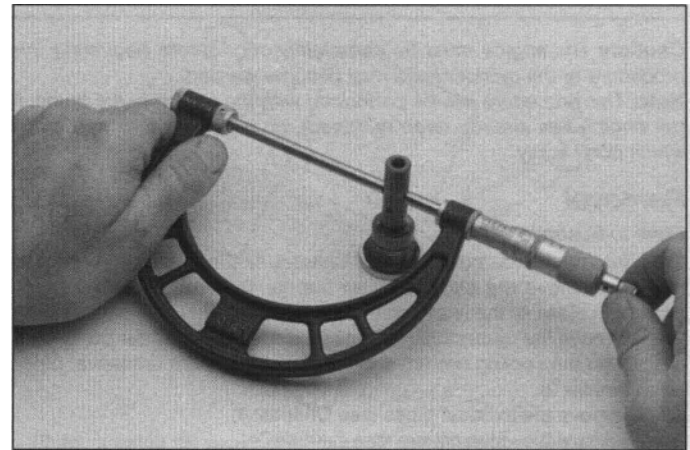
54 On 1986 through 1988 700/750 models, remove the rocker arm shaft cap and withdraw the coil spring. Thread a 10 mm diameter bolt into the end of the rocker shaft and pull on the bolt head with pliers to extract the shaft from the cylinder head. Remove the wave washer from the shaft and the O-ring from the cap.

55 Clean the parts, except for the O-ring, in clean solvent and dry them thoroughly.

Rocker arm inspection

Refer to illustrations 9.56a, 9.56b and 9.57

56 Check the camshaft lobe contact surfaces and the adjusting screw faces of the rocker arms (**see illustration**) for excessive wear, evidence of galling, chipping and cracks. Make sure the oil holes are not clogged, then measure the inside diameter of the rocker arm bore and compare it to the Specifications (**see illustration**). If any damage or excessive wear is evident, replace the rocker arms with new ones



9.57 ... and the shaft outside diameter

and check the camshaft lobes for scoring, chipping and flat spots.

57 Inspect each of the rocker arm shafts for wear, then measure their outside diameters (at both ends and the middle) and compare the results to the Specifications (**see illustration**). Replace any parts that — are worn excessively or damaged.

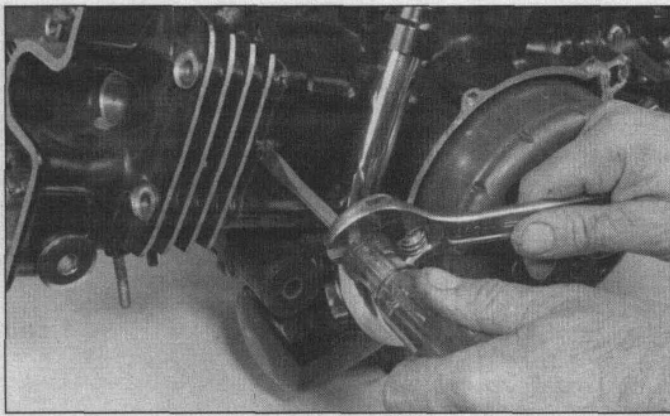
58 Inspect the rocker arm shaft wave washer and coil spring (as applicable) for damage and replace it if necessary.

Rocker arm installation

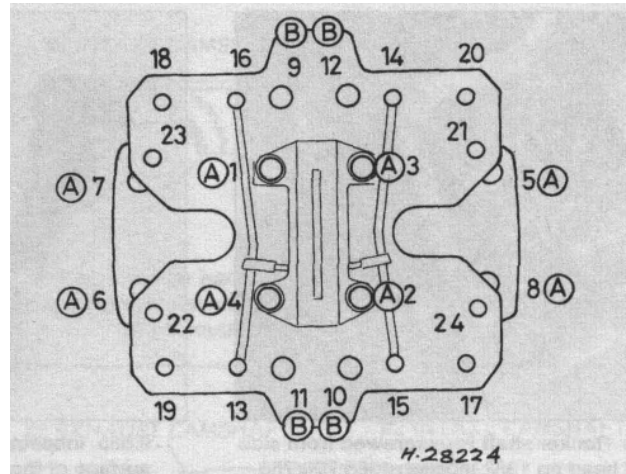
59 On 1982 through 1985 700/750 models and all 1100 models install a new O-ring on the rocker arm shaft bolt. Smear the rocker arm shaft bearing surface with molybdenum disulfide grease and apply thread locking compound to the shaft threads. Install the wave washer on the rocker arm. With the rocker arm in position, screw the rocker shaft into place, tightening it to the specified torque.

60 On 1986 through 1988 700/750 models, install the wave washer on the rocker arm and smear the shaft bearing surface with molybdenum disulfide grease. With the rocker arm in position, push the rocker shaft into place. Install the 6 mm cylinder head pin bolt in the corner hole of the cylinder head, and use a large flat-bladed screwdriver in the shaft end to rotate it so that the pin bolt passes fully down into the head casting. Leaving the pin bolt in position install the coil spring and cap, having applied thread locking compound to the cap threads and installed a new O-ring. Tighten the cap to the specified torque and remove the pin bolt.

61 Install the camshafts as described above.



10.11 Pry cylinder head off crankcase only at reinforced areas



10.22 Cylinder head/cam holder tightening sequence

10 Cylinder heads - removal and installation

Caution: The engine must be completely cool before beginning this procedure or the cylinder head may become warped. **Note:** This procedure can be performed with the engine in the frame. If the engine has already been removed, ignore the preliminary steps which don't apply.

Removal

Refer to illustration 10.11

- 1 Remove the carburetors (see Chapter 4). On 1986 700 California models, remove the secondary air supply system reed valve block from both sides of the rear cylinder bank.
- 2 Remove the carburetor rubber boots from the cylinder ports.
- 3 Drain the cooling system and remove the coolant crossover pipes (see Chapter 3).
- 4 Remove the exhaust pipes (see Chapter 4).
- 5 Remove the valve covers (see Section 7).
- 6 Remove the camshafts (see Section 9).
- 7 Remove the exterior oil pipe that runs between the two cylinder banks. Do not lose the metal washers used at the pipe banjo fittings.
- 8 Remove the rear upper engine mount bolt attached to the rear cylinder head.
- 9 Remove the camchain tensioner and slipper from both cylinder heads (see Section 8).
- 10 Remove the four cylinder head bolts located on the outside of the heads.
- 11 Using a pair of large screwdrivers or pry bars, carefully separate the head from the cylinders. Position the tools on opposite sides and pry only on the reinforced areas (**see illustration**). **Caution:** Do not wedge the tool between the gasket surfaces and do not, under any circumstances, use excessive force or the head and crankcase may be damaged.
- 12 Remove the dowel pins (note how they are installed), then peel up the old head gasket.
- 13 Using a blunt gasket scraper or similar tool, remove any trace of old gasket material left on the cylinder. Clean the gasket surfaces of the head and cylinders with a solvent such as lacquer thinner or acetone.
- 14 For disassembly of the cylinder head components, refer to Sections 11 and 12. If the cam chain guides must be removed for further disassembly of the engine, refer to Section 8.

Installation

Refer to illustration 10.22

- 15 Install the dowel pins (with new O-rings) and lay the new head gasket in place. Never re-use the old gasket and do not use any type of gasket sealer. If the camchain guides were removed, install them at

- | | | | |
|---|---|---|-------------------------------------|
| A | 9 mm bolts/nuts (700/750 models), 10 mm bolts (1100 models) | B | 8 mm bolts
Others are 6 mm bolts |
|---|---|---|-------------------------------------|

Note: 6 mm bolts 17 through 20 are pin type on 1986 through 1988 700/750 models, plain on all others. **Note:** 6 mm bolts 21 through 24 only fitted to 1986-on 700/750 models

this stage (see Section 8).

- 16 Place the cylinder heads into position on the crankcase and feed the camchains through the center cavity.

17 Prior to installing the cylinder head bolts (nuts on 1987 and 1988 700/750 Magna models), the camchain tensioner should be locked to keep slack off of the chain during installation of the camshafts and subsequent valve timing (see Section 8).

18 Place the tensioner base into position in the cylinder head and thread the chain over it. Do not install the tensioner base bolts yet. Attach the slipper to the tensioner with the clevis pin and clip and insert the lower end of the slipper into its holder located in the crankcase cavity. **Caution:** Engine damage will occur if the slipper end is not located properly in the holder socket.

19 Repeat the tensioner locking and installation procedure on the other cylinder head.

20 Install the four outer cylinder head bolts (nuts on 1987 and 1988 700/750 Magna models), tightening them only lightly at this stage.

21 Install the camshafts. It is important that the procedure described in Section 9 be followed carefully as maintaining correct valve timing is critical. **Note:** After the cam holders and sprockets, as well as the oil pipe, have been installed and the bolts tightened, unlock the cam chain tensioner (see Section 8). After unlocking the tensioner, install and tighten the tensioner base bolts.

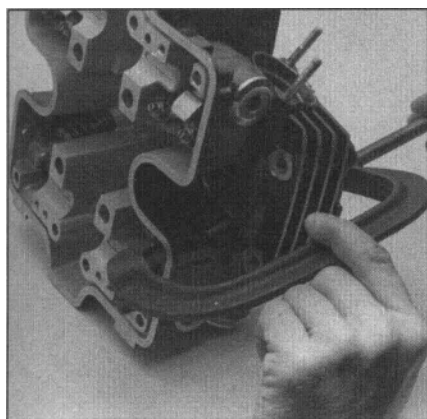
22 With the camshafts and camchain installed, refer to the tightening sequence and tighten the cylinder head/cam holder bolts and nuts evenly in two or three stages to the specified torque (**see illustration**).

23 The remainder of the cylinder head installation procedure is the reverse of the removal procedure, while taking note of the following.

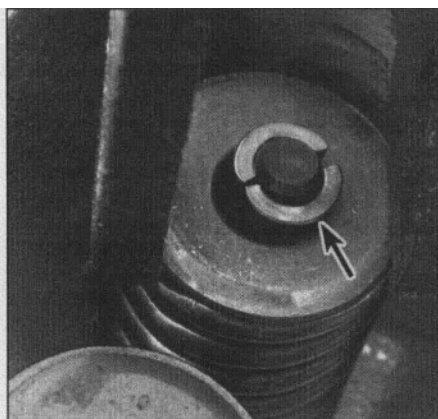
- a) Use new sealing washers on the external oil pipe union bolts.
- b) Before installing the valve covers, adjust the valve clearances as described in Chapter 1.
- c) Refill the cooling system as described in Chapter 1.
- d) Fill the crankcase to the proper level with engine oil, referring to Chapter 1 if necessary.

11 Valves/valve seats/valve guides - servicing

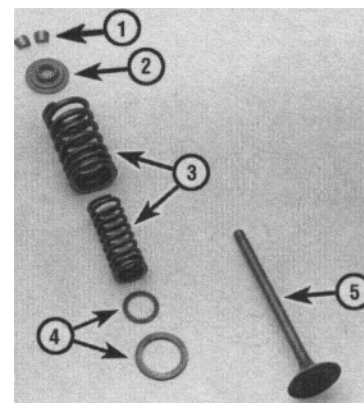
1 Because of the complex nature of this job and the special tools and equipment required, servicing of the valves, the valve seats and the valve guides (commonly known as a valve job) is best left to a professional.



12.7a Use a spring compressor to depress valve spring safely ...



12.7b ... then remove keepers/collets (arrow) and release spring pressure slowly



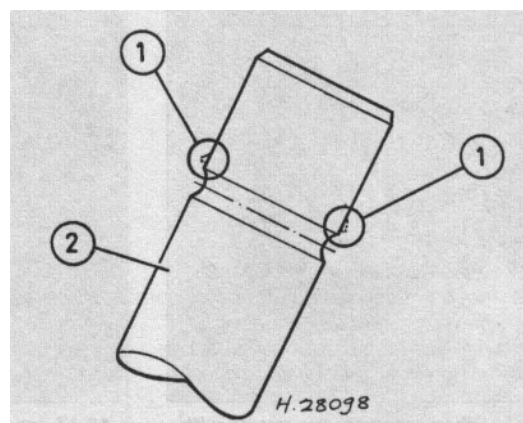
12.7c Valve components

- | | |
|---------------------|-----------------|
| 1 Keepers (collets) | 3 Valve springs |
| 2 Spring retainer | 4 Spring seats |
| | 5 Valve |

2 The home mechanic can, however, remove and disassemble the head, do the initial cleaning and inspection, then reassemble and deliver the head to a dealer service department or properly equipped motorcycle repair shop for the actual valve servicing. Refer to Section 12 for those procedures.

3 The dealer service department will remove the valves and springs, recondition or replace the valves and valve seats, replace the valve guides, check and replace the valve springs, spring retainers and keepers (collets) (as necessary), replace the valve seals with new ones and reassemble the valve components.

4 After the valve job has been performed, the head will be in like-new condition. When the head is returned, be sure to clean it again very thoroughly before installation on the engine to remove any metal particles or abrasive grit that may still be present from the valve service operations. Use compressed air, if available, to blow out all the holes and passages.



12.7d If valve (2) won't pull through guide, deburr area around keeper/collet groove (1)

12 Cylinder head and valves - disassembly, inspection and reassembly

1 As mentioned in the previous Section, valve servicing and valve guide replacement should be left to a dealer service department or motorcycle repair shop. However, disassembly, cleaning and inspection of the valves and related components can be done (if the necessary special tools are available) by the home mechanic. This way no expense is incurred if the inspection reveals that service work is not required at this time.

2 To properly disassemble the valve components without the risk of damaging them, a valve spring compressor is absolutely necessary. This special tool can usually be rented, but if it's not available, have a dealer service department or motorcycle repair shop handle the entire process of disassembly, inspection, service or repair (if required) and reassembly of the valves.

Disassembly

Refer to illustrations 12.7a, 12.7b, 12.7c and 12.7d

3 Remove the rocker arms if you haven't already done so (see Section 9). Store the components in such a way that they can be returned to their original locations without getting mixed up.

4 Before the valves are removed, scrape away any traces of gasket material from the head gasket sealing surface. Work slowly and do not nick or gouge the soft aluminum of the head. Gasket removing solvents, which work very well, are available at most motorcycle shops and auto parts stores.

5 Carefully scrape all carbon deposits out of the combustion chamber area. A hand held wire brush or a piece of fine emery cloth

can be used once the majority of deposits have been scraped away. Do not use a wire brush mounted in a drill motor, or one with extremely stiff bristles, as the head material is soft and may be eroded away or scratched by the wire brush.

6 Before proceeding, arrange to label and store the valves along with their related components so they can be kept separate and reinstalled in the same valve guides they are removed from (labeled plastic bags work well for this).

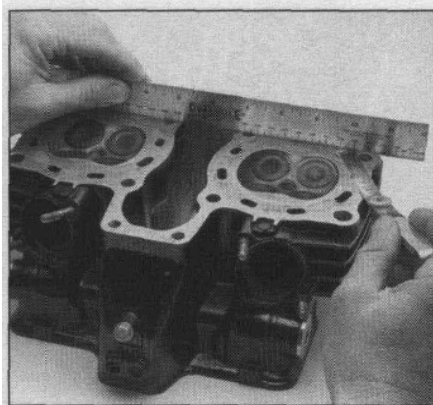
7 Compress the valve spring on the first valve with a spring compressor, then remove the keepers (collets) and the retainer from the valve assembly. **Note:** Take great care not to mark the cylinder head follower bore with the spring compressor. Do not compress the springs any more than is absolutely necessary. Carefully release the valve spring compressor and remove the springs and the valve from the head. If the valve binds in the guide (won't pull through), push it back into the head and deburr the area around the keeper (collet) groove with a very fine file or whetstone (see illustrations).

8 Repeat the procedure for the remaining valves. Remember to keep the parts for each valve together so they can be reinstalled in the same location.

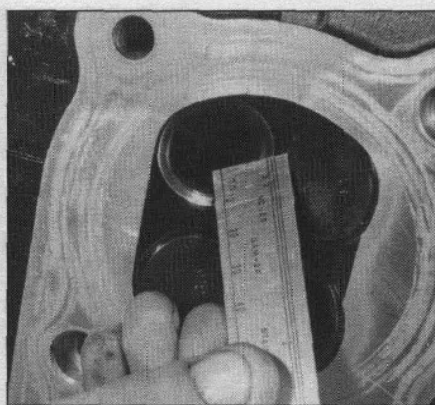
9 Once the valves have been removed and labeled, pull off the valve stem seals with pliers and discard them (the old seals should never be re-used), then remove the spring seats.

10 Next, clean the cylinder head with solvent and dry it thoroughly. Compressed air will speed the drying process and ensure that all holes and recessed areas are clean.

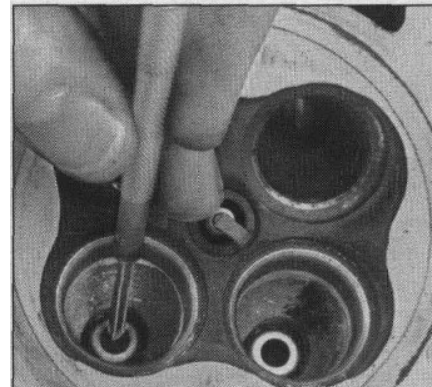
11 Clean all of the valve springs, keepers (collets), retainers and



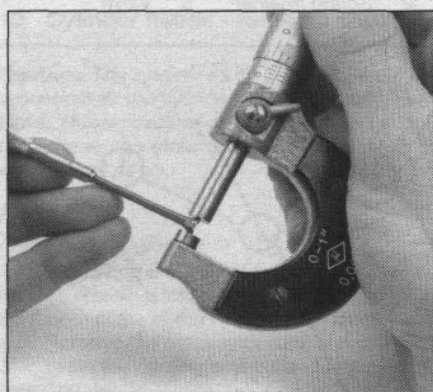
12.14 Checking the cylinder head gasket surface for warpage



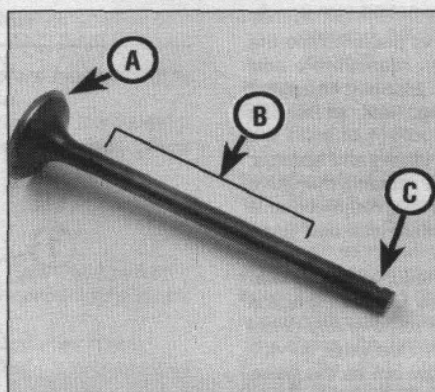
12.15 Measuring valve seat width



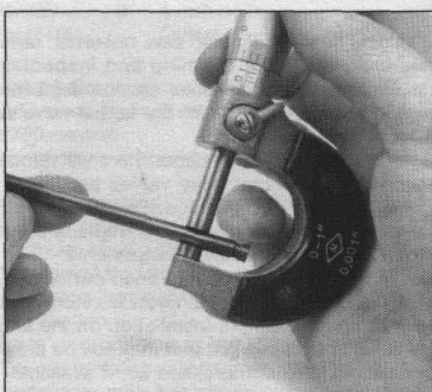
12.16a Use a small hole gauge to measure valve guide inside diameter...



12.16b ... then measure the gauge with a micrometer



12.17 Inspect the valve seat (A), stem (B) and keeper/collet groove (C) for damage



12.18 Measuring the valve stem outside diameter

spring seats with solvent and dry them thoroughly. Do the parts from one valve at a time so that no mixing of parts between valves occurs.

12 Scrape off any deposits that may have formed on the valve, then use a motorized wire brush to remove deposits from the valve heads and stems. Again, make sure the valves do not get mixed up.

Inspection

Refer to illustrations 12.14, 12.15, 12.16a, 12.16b, 12.17, 12.18, 12.19a and 12.19b

13 Inspect the head very carefully for cracks and other damage. If cracks are found, a new head will be required. Check the cam bearing surfaces for wear and evidence of seizure. Check the camshafts and rocker arms for wear as well (see Section 9).

14 Using a precision straightedge and a feeler gauge, check the head gasket mating surface for warpage. Lay the straightedge lengthwise, across the head and diagonally (corner-to-corner), intersecting the head stud holes, and try to slip a feeler gauge under it, on either side of each combustion chamber (see illustration). The gauge should be the same thickness as the cylinder head warp limit listed in this Chapter's Specifications. If the feeler gauge can be inserted between the head and the straightedge, the head is warped and must either be machined or, if warpage is excessive, replaced with a new one.

15 Examine the valve seats in each of the combustion chambers. If they are pitted, cracked or burned, the head will require valve service that's beyond the scope of the home mechanic. Measure the valve seat width and compare it to this Chapter's Specifications (see

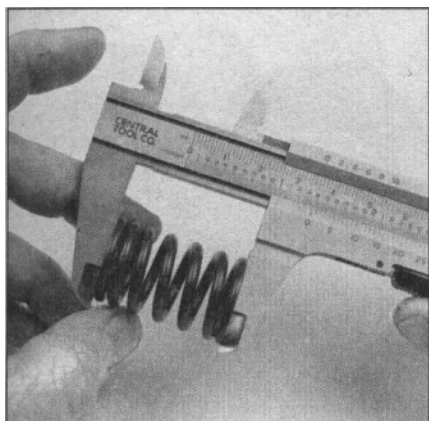
illustration). If it exceeds the service limit, or if it varies around its circumference, valve service work is required.

16 Clean the valve guides to remove any carbon build-up, then measure the inside diameters of the guides (at both ends and the center of the guide) with a small hole gauge and micrometer (see illustrations). Record the measurements for future reference. These measurements, along with the valve stem diameter measurements, will enable you to compute the valve stem-to-guide clearance. This clearance, when compared to the Specifications, will be one factor that will determine the extent of the valve service work required. The guides are measured at the ends and at the center to determine if they are worn in a bell-mouth pattern (more wear at the ends). If they are, guide replacement is an absolute must.

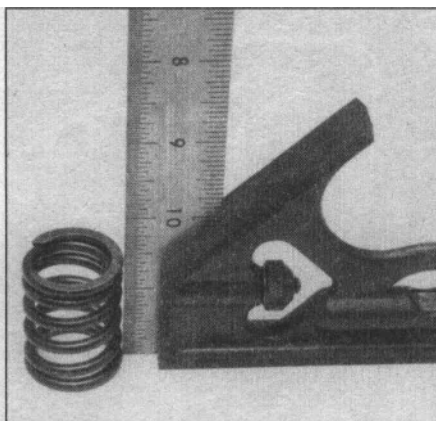
17 Carefully inspect each valve face for cracks, pits and burned spots (see illustration). Check the valve stem and the keeper (collet) groove area for cracks. Rotate the valve and check for any obvious indication that it is bent. Check the end of the stem for pitting and excessive wear. The presence of any of the above conditions indicates the need for valve servicing.

18 Measure the valve stem diameter (see illustration). By subtracting the stem diameter from the valve guide diameter, the valve stem-to-guide clearance is obtained. If the stem-to-guide clearance is greater than listed in this Chapter's Specifications, the guides and valves will have to be replaced with new ones.

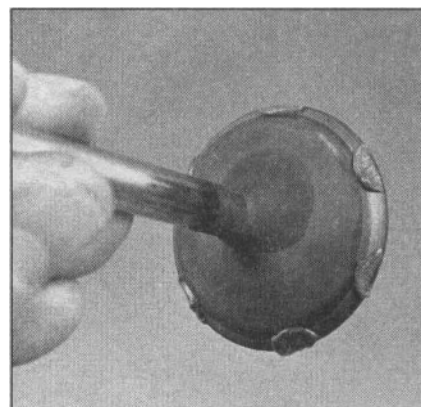
19 Check the end of each valve spring for wear and pitting. Measure the free length and compare it to this Chapter's Specifications. Any springs that are shorter than specified have sagged and should not be



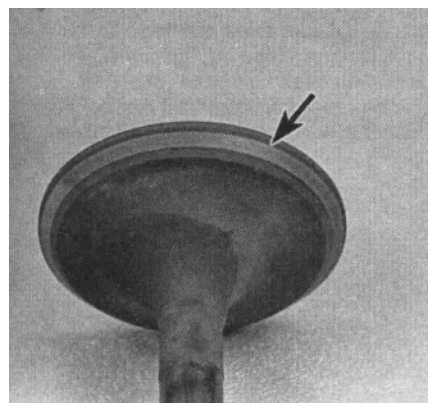
12.19a Measuring the valve spring free length



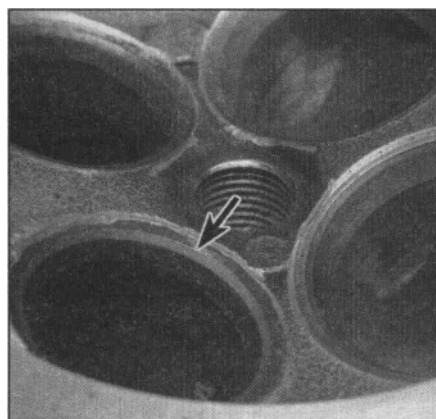
12.19b Measuring the valve springs for squareness



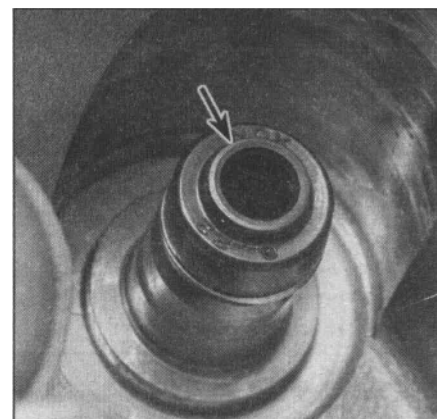
12.23 Apply valve lapping compound sparingly to the valve face



12.24a After lapping, the valve face should exhibit a uniform, unbroken contact pattern (arrow)...



12.24b ... and the seat should be the specified width (arrow) with a smooth, unbroken appearance



12.27 Install new valve stem seals (arrow) on the guides

re-used. Stand the spring on a flat surface and check it for squareness (**see illustrations**).

20 Check the spring retainers and keepers (collets) for obvious wear and cracks. Any questionable parts should not be re-used, as extensive damage will occur in the event of failure during engine operation.

21 If the inspection indicates that no service work is required, the valve components can be reinstalled in the head.

Reassembly

Refer to illustrations 12.23, 12.24a, 12.24b and 12.27

22 Before installing the valves in the head, they should be lapped to ensure a positive seal between the valves and seats. This procedure requires coarse and fine valve lapping compound (available at auto parts stores) and a valve lapping tool. If a lapping tool is not available, a piece of rubber or plastic hose can be slipped over the valve stem (after the valve has been installed in the guide) and used to turn the valve.

23 Apply a small amount of coarse lapping compound to the valve face, then slip the valve into the guide (**see illustration**). **Note:** Make sure the valve is installed in the correct guide and be careful not to get any lapping compound on the valve stem.

24 Attach the lapping tool (or hose) to the valve and rotate the tool between the palms of your hands. Use a back-and-forth motion rather than a circular motion. Lift the valve off the seat and turn it at regular intervals to distribute the lapping compound properly. Continue the

lapping procedure until the valve face and seat contact area is of uniform width and unbroken around the entire circumference of the valve face and seat (**see illustrations**).

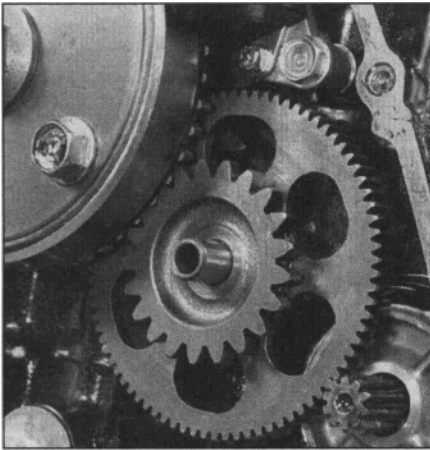
25 Carefully remove the valve from the guide and wipe off all traces of lapping compound. Use solvent to clean the valve and wipe the seat area thoroughly with a solvent soaked cloth.

26 Repeat the procedure with fine valve lapping compound, then repeat the entire procedure for the remaining valves.

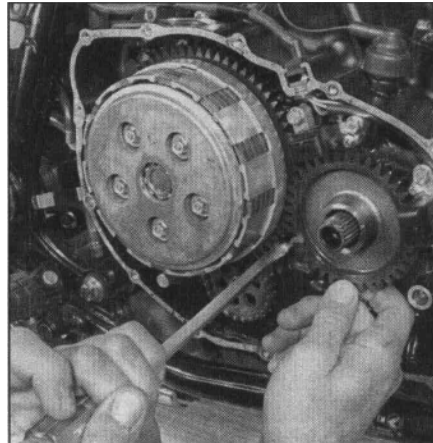
27 Lay the spring seats in place in the cylinder head, then install new valve stem seals on each of the guides (**see illustration**). Use an appropriate size deep socket to push the seals into place until they are properly seated. Don't twist or cock them, or they will not seal properly against the valve stems. Also, don't remove them again or they will be damaged.

28 Coat the valve stems with clean engine oil, then install one of them into its guide. Next, install the springs and retainer, compress the springs and install the keepers (collets). **Note:** Install the springs with their tightly wound coils at the bottom (next to the spring seat). When compressing the springs with the valve spring compressor, depress them only as far as is absolutely necessary to slip the keepers (collets) into place. Apply a small amount of grease to the keepers (collets) to help hold them in place as the pressure is released from the springs. Make certain that the keepers (collets) are securely locked in their retaining grooves.

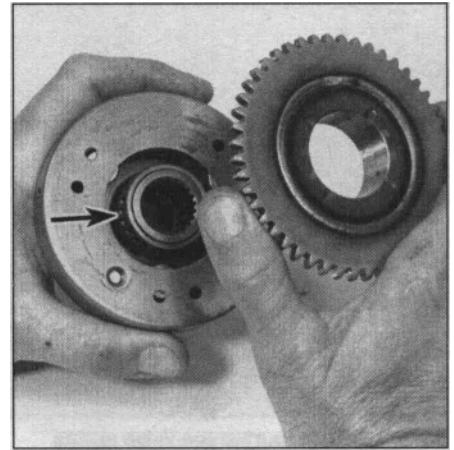
29 Support the cylinder head on blocks so the valves can't contact the workbench top, then very gently tap each of the valve stems with a



13.5 Extract its shaft, and maneuver the starter idler gear out of the casing



13.9 Taking the load off the primary drive gear so that it can be pulled off the crankshaft splines



13.10 Detach the driven gear and needle bearing (arrow) from the starter clutch

soft-faced hammer. This will help seat the keepers (collets) in their grooves.

30 Once all of the valves have been installed in the head, check for proper valve sealing by pouring a small amount of solvent into each of the valve ports. If the solvent leaks past the valve(s) into the combustion chamber area, disassemble the valve(s) and repeat the lapping procedure, then reinstall the valve(s) and repeat the check. Repeat the procedure until a satisfactory seal is obtained.

13 Starter motor clutch and primary drive gear - removal, overhaul and installation

Note: The starter motor clutch can be removed with the engine in the frame.

Removal

Refer to illustrations 13.5 and 13.9

- 1 Drain the engine oil (see Chapter 1).
- 2 On all models remove the rear brake pedal, and on 1100 Magna models also remove the right footpeg.
- 3 Remove the right crankcase cover bolts. There are two different size bolts, so make a note of their location or store them in the old gasket when this has been removed. Note that one of the cover bolts secures the rear brake light switch on 1985 through 700/750 Magna models.
- 4 Tap the crankcase cover gently with a soft-faced hammer to break the gasket seal, then pull it away from the engine. Do not pry between the gasket sealing surfaces, as damage and eventually oil leaks will occur. Discard the old gasket and remove the dowels for safekeeping if they are loose.
- 5 Pull the starter idler gear shaft out of the casing and remove the idler gear (**see illustration**). The shaft should simply pull out - it may even pull out as the casing is removed.
- 6 Remove the starter clutch bolt from the crankshaft end. The crankshaft will have to be locked to allow the bolt to be loosened. This can be achieved in one of several ways.
 - a) Have an assistant hold the alternator rotor with a strap wrench around its periphery, or the Honda service tool described in Section 19.
 - b) On 1987 and 1988 700/750 Magna models the Honda sprag-type gear holder tool (part no. 07724-0010100) can be used to lock the primary drive gear and clutch housing.
 - c) If the engine is in the frame, shift the transmission into sixth gear and have an assistant sit on the bike with the rear brake held on firmly (refit pedal temporarily if removed).

7 If the starter clutch is to be disassembled, the three starter clutch cover bolts should also be broken loose at this time (while the alternator is being held). Do not remove these bolts yet.

8 Withdraw the starter clutch assembly and thrust washer from the crankshaft splines, taking care not to knock the ignition system pulse generators.

9 Use a screwdriver engaged in the teeth of the clutch housing gear to take the load off the primary drive gear. The primary drive gear can then be pulled off its shaft (**see illustration**).

Overhaul

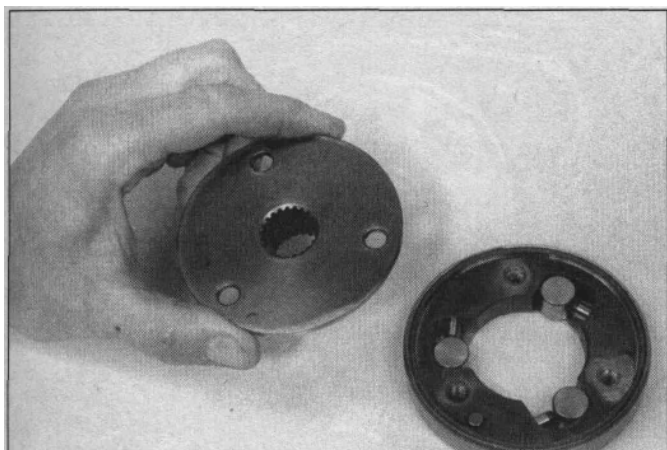
Refer to illustrations 13.10, 13.12 and 13.15

- 10 Remove the starter driven gear and needle bearing from the starter clutch (**see illustration**).
- 11 Inspect the rollers of the needle bearing for smooth operation and replace it if necessary.
- 12 Remove the three bolts from the starter clutch cover and lift off the cover (**see illustration**).
- 13 Remove the clutch rollers, plungers and springs.
- 14 Check the rollers and plungers for excessive wear, scratches or score marks and replace them if necessary.
- 15 Inspect the inner and outer surfaces of the starter driven gear for scratches and score marks. Also measure the outer diameter of the driven gear and compare it with the service limit Specifications at the beginning of this Chapter (**see illustration**).
- 16 Inspect the splines of the starter clutch cover. Any component which is not in good condition should be replaced with a new one.
- 17 To begin reassembly, install the springs into their bores in the starter clutch, then install the plungers into their bores and retain them by installing the rollers.
- 18 Install the starter clutch cover onto the starter clutch. Be sure the dowel pin in the starter clutch is aligned with the hole in the cover, then tighten the cover bolts to the specified torque. **Note:** A liquid locking agent should be applied to the bolt threads prior to installation.
- 19 With the starter clutch positioned with the cover down, insert the needle bearing into place. Install the starter driven gear by depressing it into the starter clutch while turning it counterclockwise (anticlockwise).

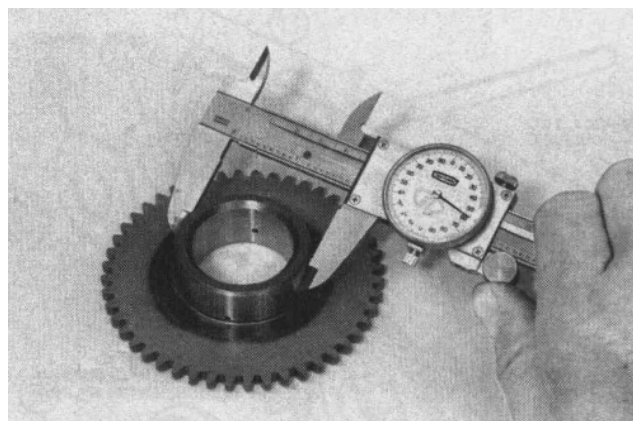
Installation

Refer to illustration 13.20

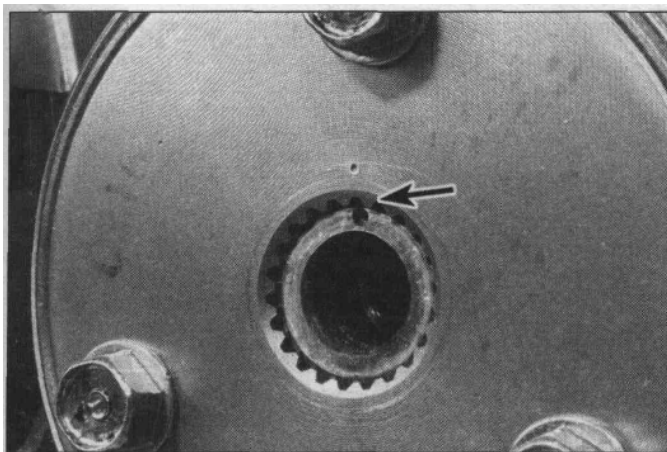
- 20 Installation is the reverse of the removal procedure with the following notes. a) It is easier to install the starter idler gear and shaft after installation of the primary drive gear but before installation of the starter clutch.



13.12 Remove the three bolts to separate the starter clutch

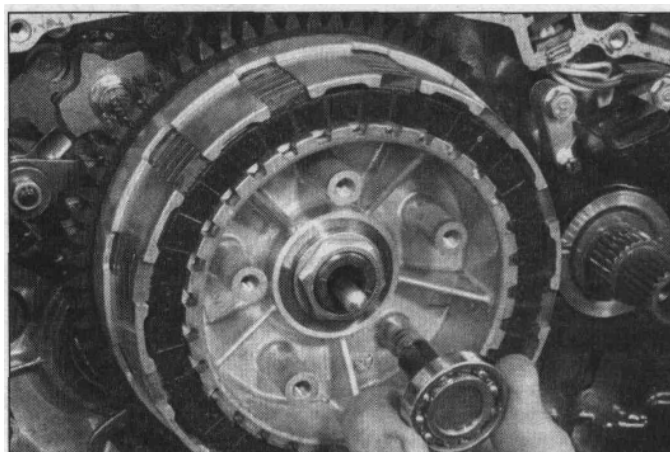


13.15 Measuring the starter driven gear outside diameter



13.20 Align punch marks on crankshaft and starter clutch on installation

- b) When installing the starter clutch on the crankshaft, be sure that the punch marks on the clutch and shaft are aligned (see illustration).
- c) The alternator rotor will again have to be held stationary while the starter clutch bolt is tightened to the specified torque.
- d) Install a new gasket, using a dab of grease to stick it to the crankcase while the cover is installed. Be sure the longer bolts are reinstalled in their original places.
- e) Refill the crankcase with the proper amount and grade of oil. Refer to Chapter 1 if necessary.



14.7 Removing clutch lifter guide and release bearing

14 Clutch - removal, inspection and installation

Note: This procedure can be performed with the engine in the frame. If the engine has already been removed, ignore the preliminary steps which don't apply. **Note:** Do not operate the clutch lever after removal of the bolts as this will cause difficulty in reassembling the clutch.

Removal

Refer to illustrations 14.7, 14.11 a, 14.11b, 14.12 and 14.13

1 Drain the engine oil (see Chapter 1).

2 On all models remove the rear brake pedal, and on 1100 Magna models also remove the right footpeg.

3 Remove the right crankcase cover bolts. There are two different size bolts, so make a note of their location or store them in the old gasket when this has been removed. Note that one of the cover bolts secures the rear brake light switch on 1985 through 1988 700/750 Magna models.

4 Tap the crankcase cover gently with a soft-faced hammer to break the gasket seal, then pull it away from the engine. Do not pry between the gasket sealing surfaces, as damage and eventually oil leaks will occur. Discard the old gasket and remove the dowels for safekeeping if they are loose.

5 Remove the starter clutch and primary drive gear as described in Section 13.

All 700/750 models except the 1983 750 Sabre

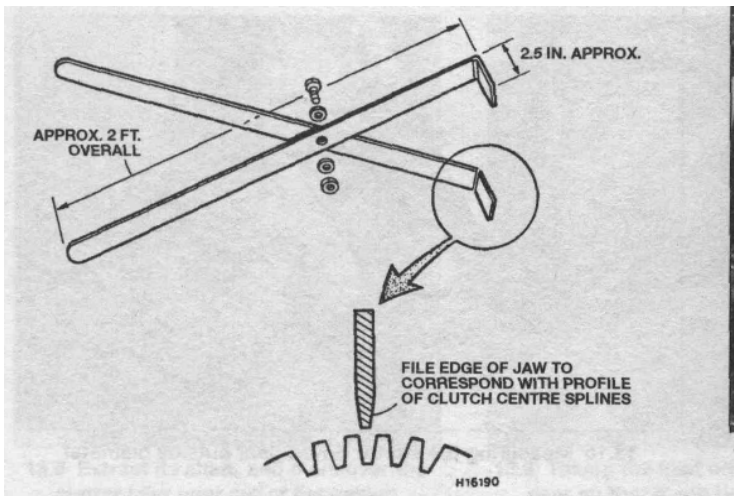
6 Remove the five bolts which retain the clutch pressure plate. Loosen these bolts gradually, one turn at a time each, following a crisscross pattern, until the pressure from the springs has been released. With the bolts removed, lift out the springs.

7 Lift off the clutch pressure plate, along with the lifter guide and release bearing (see illustration).

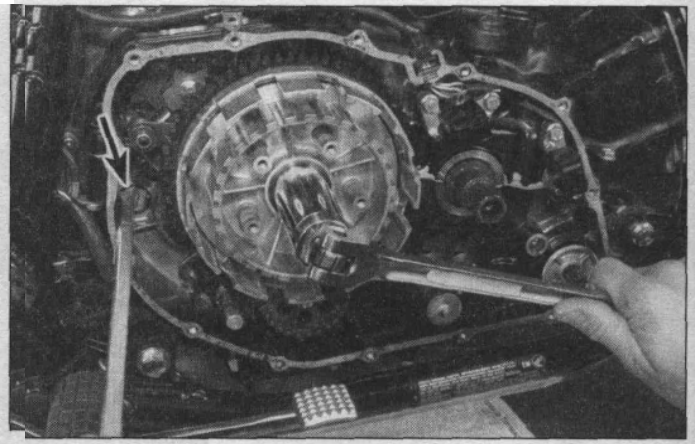
8 Pull out the lifter rod extending from the clutch center.

9 Remove the clutch plates. These can be removed either all at once or one at a time.

10 On 1987 and 1988 models knock back the lockwasher tabs from the clutch center locknut.



14.11a Clutch holding tool made from steel strap



14.11b Gear train can be locked through hole in casing - exercise extreme care

11 In order to loosen the clutch center nut, you'll need to prevent the mainshaft from rotating. The following methods can be used (**see illustrations**).

- If the engine is in the frame, shift the transmission into top gear and have an assistant apply the rear brake hard (install the pedal temporarily if removed) with the rear tire in firm contact with the ground.
- The Honda service tool (part no. 07923-6890101) provides another means of locking the mainshaft via the splines of the output shaft.
- The clutch center and housing can be locked together using the Honda clutch center holder (part no. 07724-0050001), or an equivalent can be made up from some steel strap bent at the ends and bolted together in the middle.
- Another means of holding the clutch center is to insert a long screwdriver through the crankcase hole to the left of the clutch and engage the blade in the gear teeth visible there. If held securely, this will prevent the clutch center from rotating while the locknut is loosened and removed.

12 With the locknut removed, lift off the lock washer and clutch center. The clutch housing and clutch housing guide can also be lifted out (**see illustration**).

1983 750 Sabre and all 1100 cc models

13 Remove the large circlip from the clutch lifter plate and withdraw the lifter plate, complete with release bearing and lifter plate guide. Withdraw the long pushrod (**see illustration**).

14 Remove the clutch center locknut and its washer. Use one of the methods described in Step 11 above to lock the mainshaft.

15 With the locknut and washer removed, lift out the spring set plate, diaphragm spring and washer. Remove the pressure plate and clutch friction and plain plates from the clutch housing.

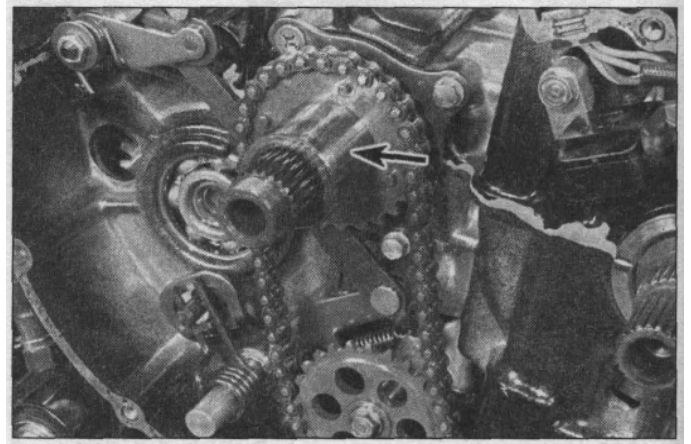
16 Remove the outer clutch center together with the one-way clutch and its inner piece. Withdraw the large washer and inner clutch center, followed by the clutch housing and its guide.

Inspection - all models

Refer to illustrations 14.18, 14.19, 14.20, 14.22 and 14.23

17 Examine the splines on both the inside and the outside of the clutch center(s). If any wear is evident, replace the clutch center(s).

18 On all 700/750 models except the 1983 750 Sabre measure the free length of the clutch springs and compare the results to the Specifications (**see illustration**). If the springs have sagged, or if cracks are noted, replace them with new ones as a set. The diaphragm spring on the 1983 750 Sabre and all 1100 models should be checked carefully for signs of cracking or fatigue - replacement is the only solution. The



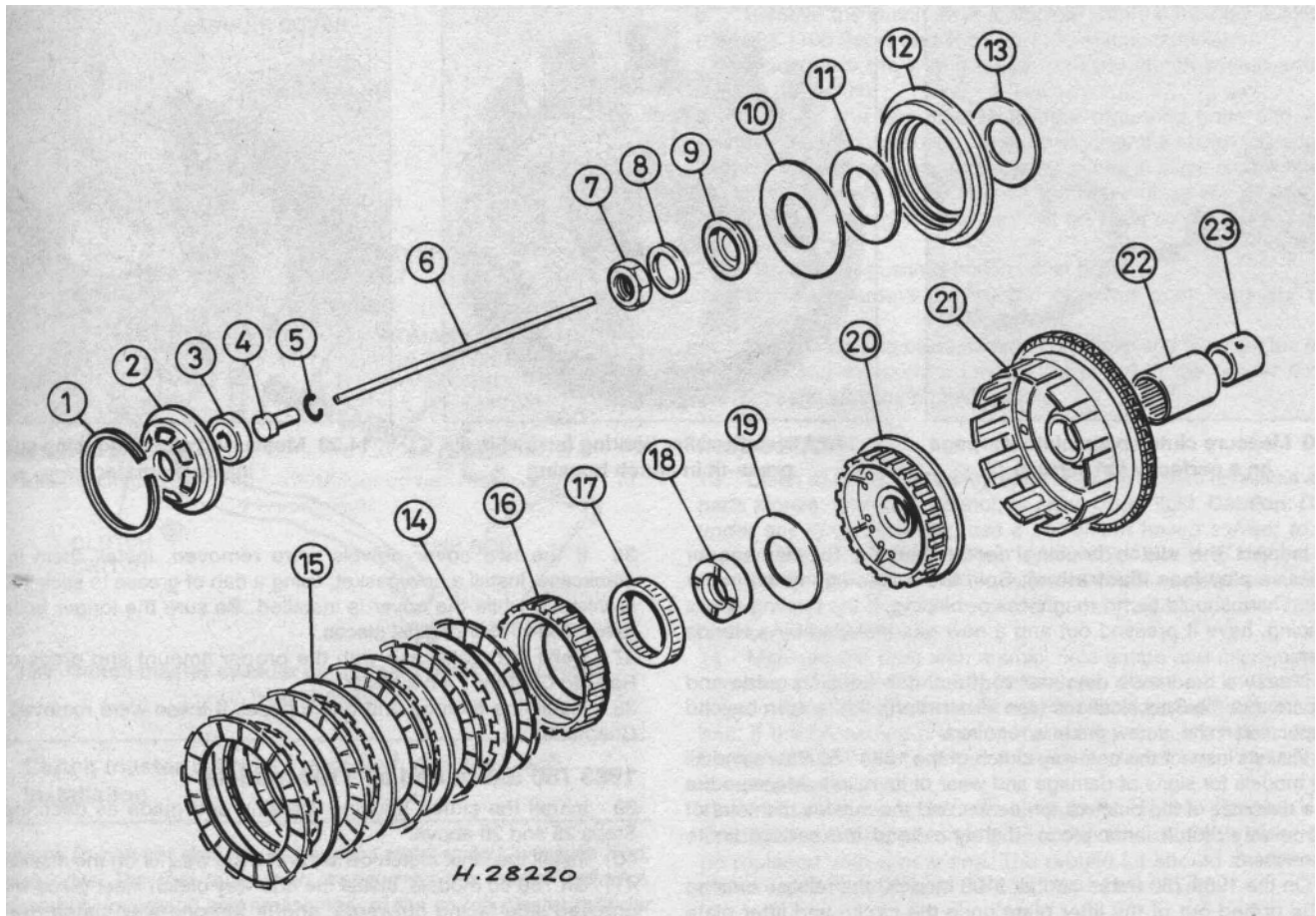
14.12 Remove the clutch housing guide (arrow) from the mainshaft

spring's free height can be measured with a tire tread-depth gauge with the spring placed dished side downward on a flat surface; if it is less than the service limit it should be replaced.

19 If the lining material of the friction plates smells burnt or if it is glazed, new parts are required. If the metal clutch plates are scored or discolored, they must be replaced with new ones. Measure the thickness of each friction plate and compare the results to the Specifications (**see illustration**). Replace with new parts any friction plates that are near the wear limit.

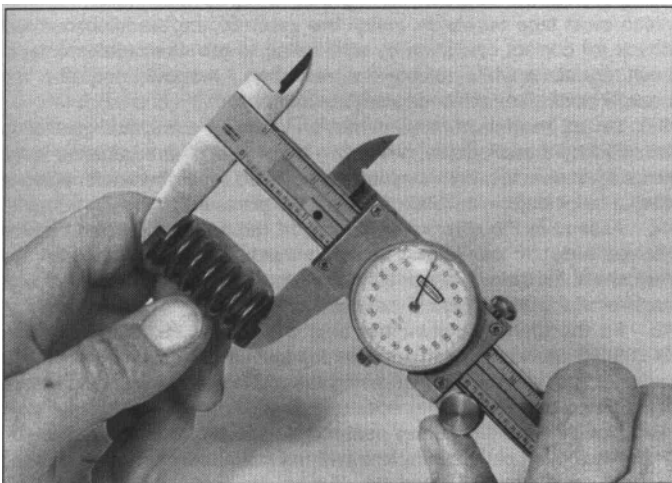
20 Lay the metal plates, one at a time, on a perfectly flat surface (such as a piece of plate glass) and check for warpage by trying to slip a 0.3 mm (0.012 in) feeler gauge between the flat surface and the plate (**see illustration**). Do this at several places around the plate's circumference. If the feeler gauge can be slipped under the plate, it is warped and should be replaced with a new one. Check the tabs on the friction plates for excessive wear and mushroomed edges. They can be cleaned up with a file if the deformation is not severe.

21 Check the edges of the slots in the clutch housing for indentations made by the friction plate tabs. If the indentations are deep they can prevent clutch release, so the housing should be replaced with a new one. If the indentations can be removed easily with a file, the life of the housing can be prolonged to an extent. Also, check the primary gear teeth for cracks, chips and excessive wear. If the gear is worn or damaged, the clutch housing must be replaced with a new one.

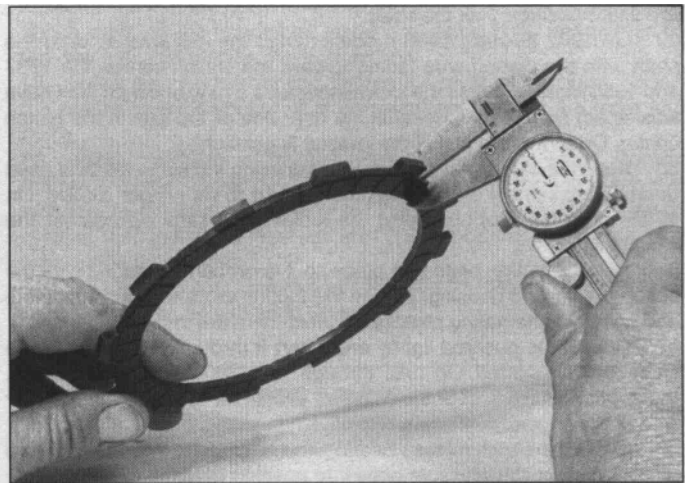


14.13 Clutch components (1983 750 Sabre and all 1100 models)

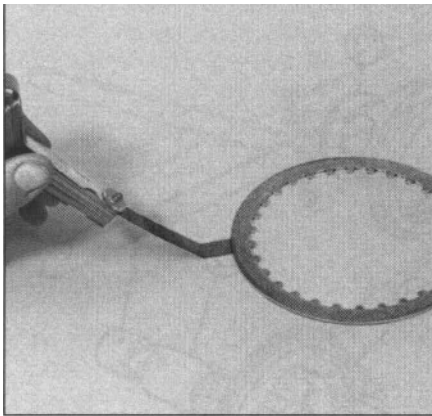
- | | | |
|----------------------|------------------------|--------------------------|
| 7 Large circlip | 9 Spring set plate | 17 One-way clutch |
| 2 Lifter plate | 10 Diaphragm spring | 18 Inner piece |
| 3 Release bearing | 11 Washer | 19 Washer |
| 4 Lifter plate guide | 12 Pressure plate | 20 Inner clutch center |
| 5 Circlip | 13 Washer | 21 Clutch housing |
| 6 Pushrod | 14 Friction plates | 22 Needle roller bearing |
| 7 Locknut | 15 Plain plates | 23 Guide |
| 8 Washer | 16 Outer clutch center | |



14.18 Measuring clutch spring free length



14.19 Measuring clutch friction plate thickness



14.20 Measure clutch plain plate warpage on a perfectly flat surface

22 Inspect the clutch housing needle bearing for damage or excessive play (**see illustration**). Spin the rollers lightly with your finger. There should be no roughness or binding. If the bearing needs replacing, have it pressed out and a new one installed by a Honda dealer.

23 Measure the inside diameter of the clutch housing guide and compare it to the Specifications (**see illustration**). If it is worn beyond the specified limits, a new guide is required.

24 Visually inspect the one-way clutch of the 1983 750 Sabre and all 1100 models for signs of damage and wear of its rollers. Measure the inside diameter of the outer clutch center and the outside diameter of the one-way clutch inner piece. If they exceed the service limits replace them.

25 On the 1983 750 Sabre and all 1100 models, the release bearing can be drifted out of the lifter plate once the circlip and lifter plate guide have been removed.

Installation

All 700/750 models except the 1983 750 Sabre

26 Apply a coat of engine oil to the inside and outside of the clutch housing guide and install it over the mainshaft.

27 If the needle bearing was removed from the clutch housing reinstall it. Then install the clutch housing into position over the guide. Be sure the holes in the rear of the housing engage with the pins protruding from the oil pump drive sprocket behind the guide.

28 Lubricate the inner splines of the clutch center with engine oil and slip it into position over the shaft.

29 On 1982 through 1986 models install the lockwasher onto the shaft with the dished side facing toward the clutch center. On 1987 and 1988 models, install the lockwasher (use a new one if its tabs have weakened) so that its extension fits over one of the ribs in the clutch center. On all models install the locknut finger-tight.

30 Keep the clutch center from rotating using the same method used during disassembly and tighten the locknut to its proper torque. On 1987 and 1988 models, bend the lockwasher tabs up against the locknut sides.

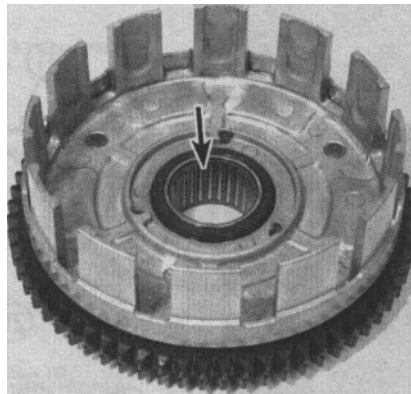
31 Install a friction plate into place so it is properly engaged with the clutch center and housing. Follow the friction plate with a metal plate and continue alternating plates until all of them are installed.

32 Grease the pushrod lightly and insert it through the center of the shaft until it is seated. On 1985 through 1988 700/750 Magna models, the gold anodized end of the pushrod should be on the slave cylinder side of the engine.

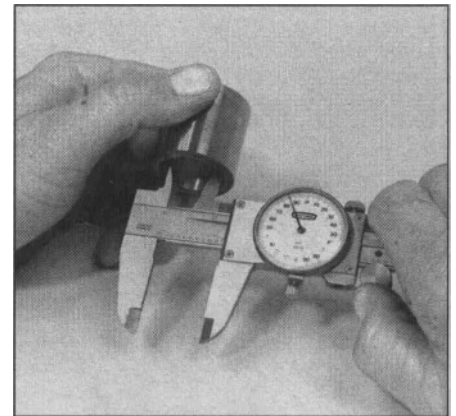
33 Install the clutch release bearing and lifter guide into the pressure plate and place the pressure plate into position over the clutch center.

34 Place the clutch springs into place. Then install the pressure plate bolts and washers and tighten them evenly in a criss-cross pattern.

35 Reinstall the primary drive gear and starter clutch assembly.



14.22 Needle roller bearing (arrow) is a press-fit in clutch housing



14.23 Measuring clutch housing guide inside diameter

36 If the two cover dowels were removed, install them in the crankcase. Install a new gasket, using a dab of grease to stick it to the crankcase while the cover is installed. Be sure the longer bolts are reinstalled in their original places.

37 Refill the crankcase with the proper amount and grade of oil. Refer to Chapter 1 if necessary.

38 Install the footpeg and brake pedal, if these were removed (**see Chapter 6**).

1983 750 Sabre and all 1100 models

39 Install the clutch housing, bearing and guide as described in Steps 25 and 26 above.

40 Install the inner clutch center and large washer on the mainshaft.

41 On 750 cc models, install the one-way clutch inner piece with its grooved side facing outwards, and fit the one-way clutch over the inner piece with its marked side facing outwards. The outer clutch center should be installed over the one-way clutch (its grooved side faces inwards) using a counterclockwise (anticlockwise) motion. At this point, check that the one-way clutch is assembled correctly by attempting to turn the outer clutch center in both directions while holding the mainshaft - it should only turn in a counterclockwise (anticlockwise) direction.

42 On 1100 cc models, assemble the outer clutch center, one-way clutch and inner piece before installing on the mainshaft. Fit the one-way clutch to the outer clutch center with its flanged side facing into the outer clutch center. Install the inner piece into the one-way clutch using a clockwise motion, noting that the grooved face of the inner piece must face outwards. Install the assembly on the mainshaft and check for correct operation by attempting to turn the clutch center in both directions while holding the mainshaft - it should only turn in a counterclockwise (anticlockwise) direction.

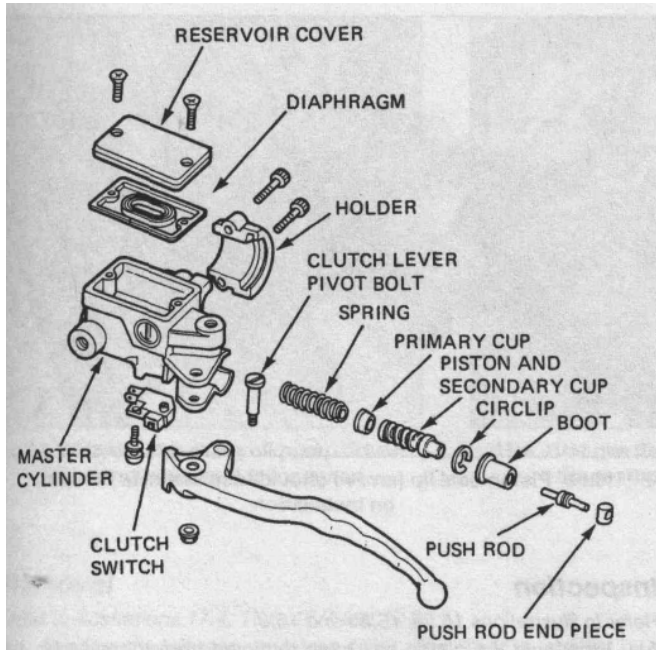
43 On all models, install a friction plate in the clutch housing, followed by a plain plate, alternating them until all are installed in the housing. If new friction plates are being fitted, coat them with a smear of engine oil before installation. Install the pressure plate.

44 Assemble the diaphragm spring on the setting plate so that the dished side of the spring faces inwards when installed on the mainshaft. Fit the washer against the inner (dished) side of the spring and install the assembly on the mainshaft.

45 Fit the dished lockwasher over the mainshaft (dished side or OUTSIDE marking facing outwards) and install the clutch center locknut. Retain the mainshaft using the method employed on removal and tighten the nut to the specified torque.

46 Lightly grease the long pushrod and slide it into the mainshaft. Install the lifter plate, complete with release bearing and guide and secure with the large circlip.

47 Refer to Steps 35 to 38 above to install the remaining components and refill the engine with the proper amount and grade of oil (**see Chapter 1**).



15.1 Clutch master cylinder component parts (early model type shown)

15 Clutch master cylinder - removal, overhaul and installation

Caution: To prevent damage to the paint from spilled hydraulic fluid, always cover the fuel tank when working on the master cylinder. Disassembly, overhaul, and reassembly of the clutch master cylinder must be done in a spotlessly clean work area to avoid contamination and possible failure of the hydraulic system components. Refer to illustration 15.1

Removal and dismantling

1 If the master cylinder is leaking fluid or if lever movement does not produce clutch disengagement, and bleeding the system does not help, master cylinder overhaul is recommended (**see illustration**). Before disassembling the master cylinder, read through the entire procedure and make sure that you have the correct rebuild kit. Also, you will need some new, clean brake fluid of the recommended type, some clean rags, internal snap-ring pliers, a O-to-1 inch micrometer and a small hole gauge.

2 Remove the left rear view mirror.

3 Refer to Chapter 1 and drain just enough fluid from the system to empty the master cylinder. **Note:** When pumping the clutch lever, do not bring it all the way back to the handlebar, as this will cause piston over-travel and fluid leakage. To prevent this, hold a 3/4 in (20 mm) spacer (made from a block of wood) between the lever and the handlebar. When the master cylinder is empty, retighten the bleeder valve on the slave cylinder.

4 To reduce the amount of air entering the clutch lines, and subsequent bleeding, the line should be securely plugged immediately after disconnecting it from the master cylinder. This can be done with an 8 x 20 mm bolt and nut.

5 Pull back the rubber boot, loosen the master cylinder banjo fitting bolt and pull the hose and bolt away from the cylinder as a unit. Have a container handy to catch any brake fluid that may drip out of the master cylinder fitting. Quickly place your finger over the end of the hollow bolt to prevent the entrance of air into the lower part of the hydraulic system. Working quickly, remove the hollow bolt, slip the 8 mm bolt (along with the sealing washers) through the banjo fitting, thread on the nut and tighten it securely. Wipe up any spilled brake fluid.

6 Remove the clutch lever (complete with the freeplay adjuster on the 1985 1100 Sabre and 1985/86 1100 Magna models).

7 Disconnect the wiring leads from the clutch switch and then remove the switch.

8 Remove the two master cylinder mounting bolts and lift the cylinder off the handlebars. On early models, the choke cable locates in the master cylinder clamp; leave the clamp in place on the cable.

9 If not already done, remove the reservoir cover, plate (where fitted) and diaphragm, plus the float on 1988 models. Drain off any residual fluid.

10 Remove the pushrod from its dust boot.

11 Carefully remove the rubber pushrod boot from the piston opening.

12 Using snap-ring pliers, remove the circlip and slide out the piston, the cups and the spring. Lay the parts out in the proper order to prevent confusion during reassembly.

Inspection

13 Clean all of the parts with brake cleaning solvent (available at auto parts stores), isopropyl alcohol, or clean brake fluid. **Caution:** Do not, under any circumstances, use a petroleum based solvent to clean these parts. If compressed air is available, use it to dry the parts thoroughly. Check the master cylinder bore for scratches, nicks and score marks. If damage is evident, the master cylinder must be replaced with a new one.

14 Measure the bore with a small hole gauge and micrometer and compare the results to the Specifications. If the bore is worn beyond the allowable limits, the master cylinder must be replaced with a new one. If the necessary precision measuring tools are not available, a dealer service department or motorcycle repair shop can make the measurements for you.

15 Measure the outside diameter of the piston and compare it to the Specifications. If the piston is worn beyond the allowable limits, it must be replaced with a new one. The rebuild kit should contain a new piston; use it regardless of the condition of the old one.

Reassembly and installation

16 Before reassembling the master cylinder, soak the new rubber cups in clean brake fluid for ten or fifteen minutes. Lubricate the master cylinder bore with clean brake fluid, then carefully insert the piston and related parts in the reverse order of disassembly. Make sure the lips on the cups do not turn inside out when the cups are slipped into the bore.

17 Install the circlip, making sure it is properly seated in its groove, then install the rubber dust boot and pushrod.

18 Attach the master cylinder to the handlebar (if the clamp has an UP marking, fit is so that it is facing upwards) and position the assembly so that the body-to-clamp top mating surface aligns with the punch mark on the handlebar. Install the clamp bolts and tighten the top one fully, followed by the bottom bolt.

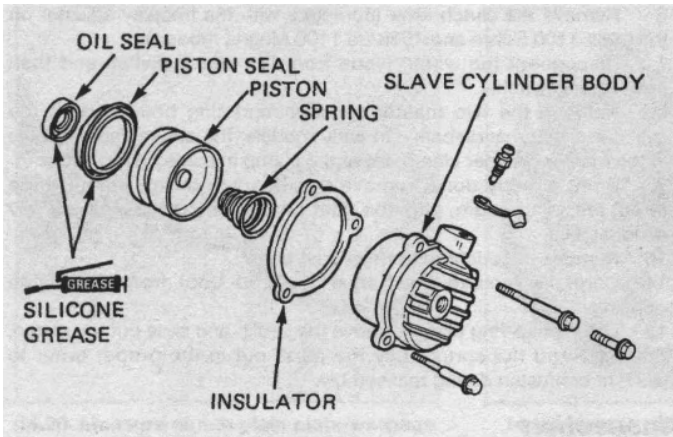
19 Install the clutch lever and tighten the pivot bolt locknut. Be sure the master cylinder pushrod is correctly engaged in the lever end-piece.

20 Install the clutch switch and hook up the switch wiring. Connect the hose to the master cylinder and install the mirror. Fill the system with new hydraulic fluid and refer to Chapter 1 to bleed the air from the system, then install the reservoir float (1988 models), diaphragm, plate (where fitted) and cover.

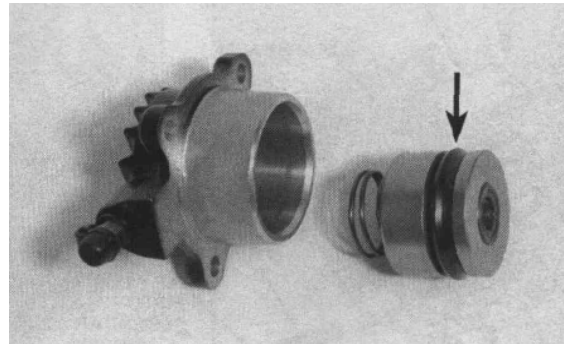
21 On the 1985 1100 Sabre and 1985/86 1100 Magnas set the clutch lever freeplay as described in Chapter 1.

16 Clutch slave cylinder - removal, overhaul and installation

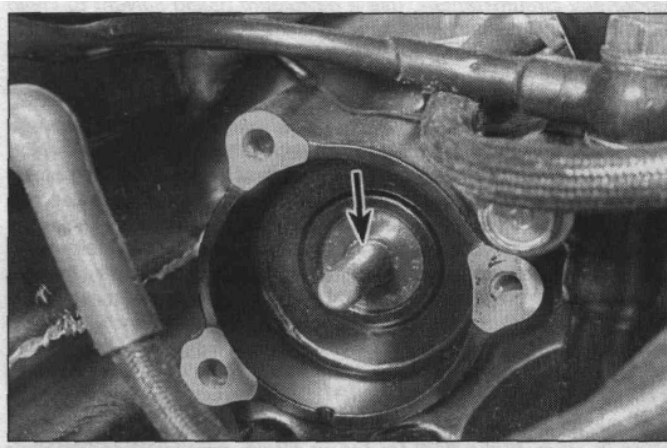
Caution: To prevent damage to the painted cycle parts from spilled brake fluid, always cover the surrounding area when working on the slave cylinder. Disassembly, overhaul, and reassembly of the clutch slave cylinder must be done in a spotlessly clean work area to avoid



16.5a Clutch slave cylinder components parts



16.5b Piston seal lip (arrow) should face towards the bore on installation



16.8 Pry pushrod oil seal out of casing when pushrod has been removed

contamination and possible failure of the hydraulic system components,

Removal and dismantling

1 Remove the left rear crankcase cover. The cover is retained by a single bolt on all 700/750 Sabre models and 1982 through 1984 700/750 Magna models; note the long collar inside the cover. On all 1100 models and 1985 through 1988 700/750 Magna models the cover is retained by three bolts.

2 Place a container under the slave cylinder to catch dripping fluid and then remove the banjo bolt that retains the fluid line coupling to the slave cylinder cover. Allow the clutch hose to drain into the container.

3 Remove the slave cylinder mounting bolts (plus the rear cover bracket bolts where the bracket might hinder removal) and withdraw the cylinder and insulating gasket from the crankcase. Note that the cylinder assembly may separate during removal. If the piston does not come out with the cylinder, pull the piston off of the clutch pushrod and remove it from the motorcycle.

4 If the piston and cylinder come out as one unit, the cylinder can be tapped with a block of wood to force the piston out. Another method is to reconnect the clutch hose to the cylinder and operate the clutch lever to force the piston out. A third method, if an air compressor is available, is to force the piston out using compressed air, but do not try to catch the piston with your hand. Always use a thick towel or rag and apply the air in short spurts.

Inspection

Refer to illustrations 16.5a, 16.5b and 16.8

5 Whenever the piston has been removed from the cylinder, the piston seal and oil seal should both be replaced. Note that the lip of the piston seal should face into the bore (**see illustrations**).

6 Inspect both the outer surface of the piston and the inner surface of the cylinder for scoring or scratches.

7 Measure the outside diameter of the piston with a micrometer and the inside diameter of the cylinder bore and compare it to the Specifications at the beginning of this Chapter. If either the piston or the cylinder needs to be replaced, both should be replaced together. Remove the spring from the piston and check it for weakness or damage.

8 With the assembly out of the crankcase, wipe the cavity clean and inspect it for the presence of any crankcase oil, which would mean a new oil seal is needed in the cavity (**see illustration**). To replace this, pull out the clutch pushrod and pry the old seal out, drive the new one in using a suitable sized socket.

Reassembly and installation

9 If the long pushrod was removed, grease it lightly and insert it into the oil seal. On 1985 through 1988 700/750 Magna models, the gold anodized end of the pushrod should be on the slave cylinder side of the engine.

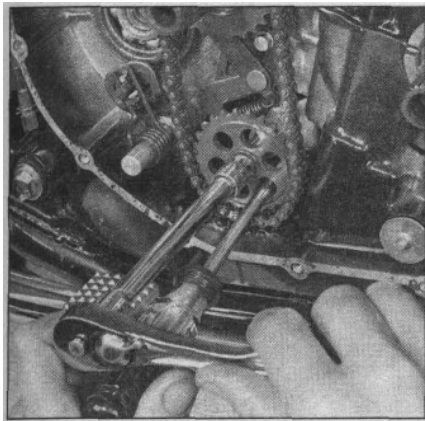
10 Assemble the slave cylinder by attaching the spring to the piston and installing the piston into the cylinder body with the oil seal side facing out. Prior to installing the piston or piston seal, lubricate them with a medium grade high-temperature silicon grease or brake fluid.

11 Installation of the assembly is the reverse of the removal procedure, while noting the following.

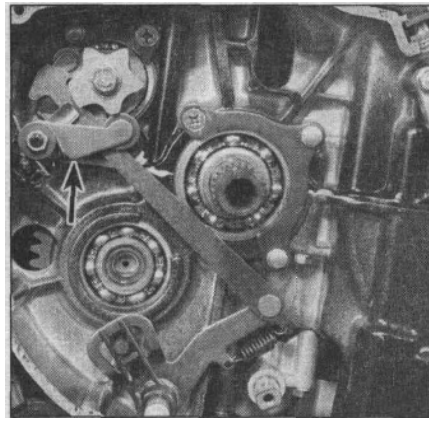
- Install the insulating gasket between the slave cylinder and crankcase.
- New sealing washers should be used on each side of the fluid line banjo bolt
- On later models ensure that the line coupling butts against the cast tab on the slave cylinder.
- Fill the clutch fluid reservoir with fresh fluid and bleed the system as described in Chapter 1.

17 External gearshift mechanism - removal, inspection and installation

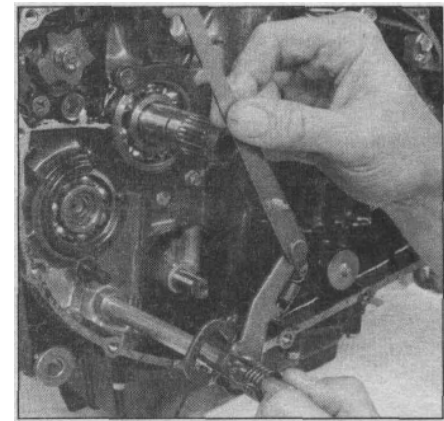
Note: The gearshift mechanism components can be removed with the engine in the frame. If work is being carried out with the engine removed ignore the preliminary steps.



17.4 Method of locking oil pump driven sprocket while bolt is loosened



17.6 Remove its nut and withdraw the drum stopper arm (arrow)



17.7 Support the claw arm as shown and withdraw the gearshift spindle from the crankcase

Removal

Refer to illustrations 17.4, 17.6, 17.7 and 17.8

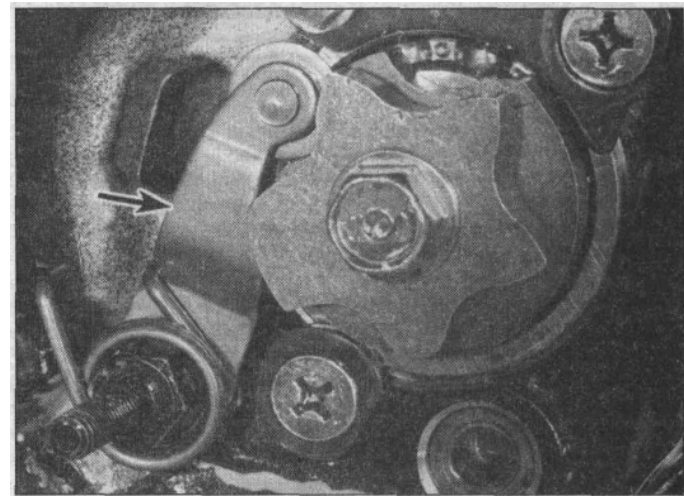
- 1 Remove the left rear crankcase cover. The cover is retained by a single bolt on all 700/750 Sabre models and 1982 through 1984 700/750 Magna models; note the long collar inside the cover. On all 1100 models and 1985 through 700/750 Magna models the cover is retained by three bolts.
- 2 Remove the gearshift lever, as described in Section 18.
- 3 Remove the clutch assembly as described in Section 14.
- 4 Insert a long screwdriver through one of the holes of the oil pump sprocket, located below the clutch, and engage it in the crankcase opening behind the sprocket (**see illustration**). This will keep the sprocket from rotating. Now remove the sprocket bolt, disengage the sprocket from the chain and lift it out.
- 5 Lift off the drive chain, and remove the oil pump drive sprocket from the mainshaft.
- 6 Make a note of the engaged position of the spring, then remove the nut that retains the drum stopper arm and lift the arm off along with its spring, collar and washers (**see illustration**).
- 7 Withdraw the complete gearshift spindle assembly from the crankcase (**see illustration**). The springs do not need to be removed from the spindle unless they are being replaced.
- 8 Disengage the spring from the neutral stopper arm. Remove the bolt and lift off the arm (**see illustration**).
- 9 Remove the shift drum cam plate bolt and lift off the cam plate. Do not lose the five pins in the cam plate.

Inspection

- 10 Clean all the parts with solvent and dry them thoroughly.
- 11 Examine the gearshift spindle for wear, particularly at the upper arm shift pawls. Make sure the shaft is not bent and check the springs for cracks and excessive stretch; the small spring at the upper arm joint was liable to fracture at its upper connecting hook on early models - ensure that this spring is replaced with the modified type, marked with yellow paint. The upper arm must be straight and free to move at its pivot point.
- 12 Check the stopper arm, the plate and the pins for excessive wear and replace any worn or damaged parts with new ones.
- 13 The gearshift shaft oil seal is located behind the output gear case on the left side of the lower crankcase half. If signs of oil leakage are evident, remove the output gear case (see Section 23) and with the gearshift shaft removed, pry the oil seal from position. Use a socket wrench as a drift to drive the new seal squarely into the crankcase.

Installation

- 14 If removed, insert the five pins in the cam plate. Position the cam plate on the shift drum so that the shift drum dowel pin is engaged in



17.8 Remove its bolt and lift off the neutral stopper arm (arrow)

the cam plate hole. Apply thread sealant to the cam plate bolt and tighten it securely.

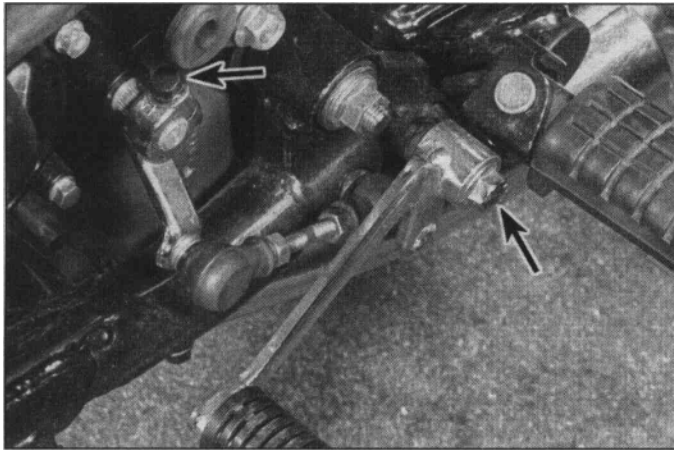
- 15 Install the neutral stopper arm and bolt. Again, apply thread sealant to the bolt before installing it. Slip the spring over the bolt and engage it with the stopper arm and crankcase boss.

16 If the springs were removed from the gearshift spindle, assemble them. Apply a smear of grease to the gearshift spindle and wrap its splines with electrical tape, so they won't damage the seal as the shaft is installed. Insert it through the crankcase ensuring that the return spring is properly engaged on the crankcase stud. Also, be sure the upper arm is correctly positioned in relation to the cam plate.

17 Assemble the drum stopper arm, spring, washers and collar into position and secure them with the retaining nut. Be sure the spring is properly engaged. On later models, the inner washer has an extension which engages the cast rib in the bottom of the casing.

18 Having removed any tape from its splines, install the gearshift lever and operate the gearshift linkage mechanism to be sure it works smoothly. Be sure the punch mark on the lever aligns with the mark on the gearshift spindle.

19 The remainder of the components are installed in the reverse order of removal. When installing the oil pump drive sprocket, the drive dogs must face outwards. If the pump driven sprocket has an IN marking on one of its faces, position the sprocket with the IN marking facing the crankcase.



18.1 Gearshift lever-to-footpeg and gearshift shaft bolts

18 Gearshift lever - removal, and installation

Removal

Sabre models

Refer to illustration 18.1

- 1 Remove the shift lever bolt that attaches it to the footpeg bracket (see illustration).
- 2 Remove the left crankcase rear cover. Remove the pinch bolt that attaches the lever assembly to the gearshift shaft and slide it off of the shaft.
- 3 If only the gearshift lever needs to be replaced, loosen the locknut on the threaded link and unscrew the balljoint from the stud. The balljoint and lever are replaced as one unit. **Note:** Prior to loosening the stud nuts, mark them with a dot of paint to show the original adjustment position.
- 4 Both balljoints should be inspected for freedom of movement. If there is any roughness or binding they should be replaced by unscrewing them from the threaded link.

Magna models

- 5 Remove the left crankcase rear cover.
- 6 Disconnect the gearshift lever from the gearshift shaft.
- 7 Remove the left footpeg bracket bolts and lift off the bracket with the gearshift lever.
- 8 Unscrew the attaching bolt and lift the gearshift lever off of the bracket.
- 9 Dismantle the balljoints and threaded link as described in Steps 3 and 4 above.

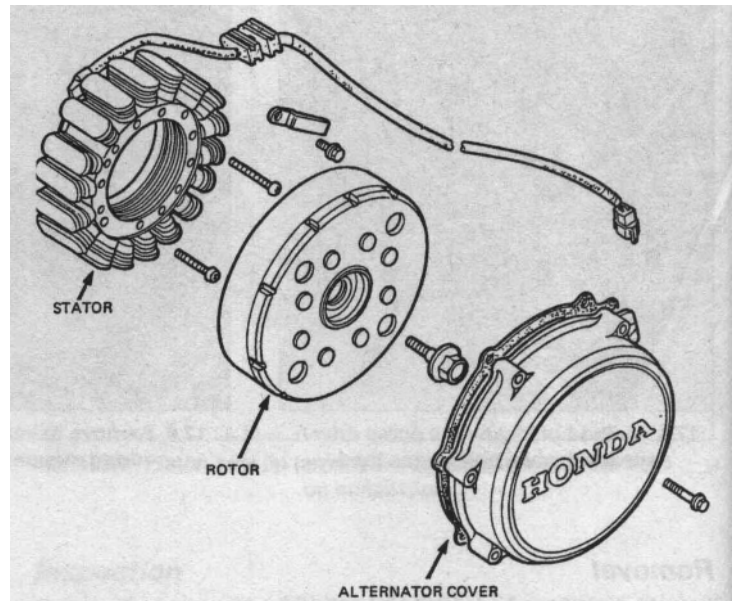
Installation - all models

10 Installation is the reverse of the removal procedure, noting the following.

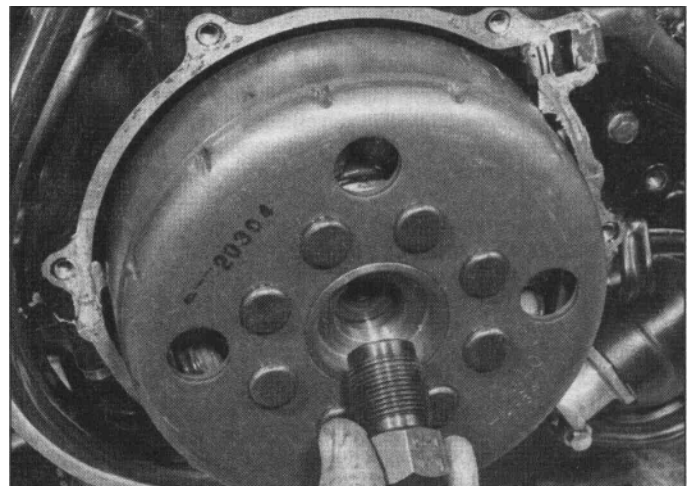
- a) When installing the gearshift lever onto the gearshift shaft ensure that the two punch marks line up.
- b) If the balljoints positions were disturbed, ensure that they are returned to their original positions on the threaded link. If no record was made, or new parts are being fitted, adjust the threaded link so that pedal height is comfortable in the riding position.

19 Alternator - removal and installation

Note: To remove the alternator rotor the special Honda rotor puller, Part Number 07733-0020001 or 07933-3290001, or a pattern equivalent will be required. Do not attempt to remove the rotor using



19.1 Alternator component parts (early type shown)



19.3 Rotor must be withdrawn using center-bolt puller

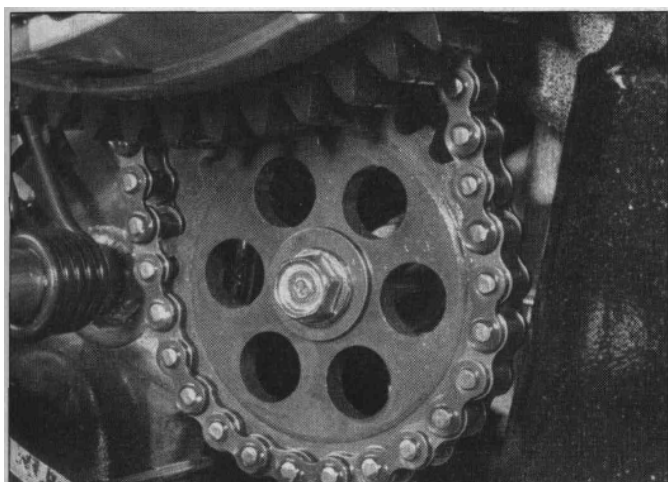
any other method. The alternator can be removed with the engine in the frame. If work is being carried out with the engine removed, ignore the preliminary steps.

Removal

Refer to illustrations 19.1 and 19.3

- 1 There will be a certain amount of oil loss when the alternator cover is removed, so make sure the motorcycle is positioned upright (on its main stand if one is fitted) and place a drain tray under the cover. Remove its six bolts and withdraw the alternator cover from the left side of the engine (see illustration).
- 2 In order to remove the rotor mounting bolt, the rotor must be kept from turning. Honda dealers can supply service tools to engage the holes in the rotor face or a band-type strap wrench to fit around the rotor periphery. Alternatively, try one of the following methods.

- a) A strap wrench can be used on the periphery of the rotor to hold it still.
- b) The engine can be locked through the transmission. If the engine is in the frame, shift it into sixth gear and have an assistant sit on the motorcycle while applying the rear brake hard.



21.15 Oil pump driven sprocket bolt

3 Once the rotor bolt has been removed, the rotor can be pulled from its shaft by screwing the special Honda tool (see Note at beginning of this section) into its thread. The tool threads into the rotor and pushes against the crankshaft to draw the rotor off its taper (**see illustration**). A bolt of the correct diameter and thread size would also work if one large enough is available. Carefully tighten the tool until the rotor pops off of the shaft. **Caution:** Be careful not to drop or strike the rotor or its magnetism will be impaired. Do not, under any circumstances use a common gear puller to remove the rotor, as damage will result.

4 If the Woodruff key in the crankshaft taper is loose, keep it with the rotor for safekeeping.

5 If the stator needs to be removed, first remove the seat and left side cover from the motorcycle to gain access to its wiring connector. Disconnect the connector and free the wiring from any clamps and ties on the frame.

6 Remove the wiring harness clamp from inside the alternator housing and free the grommet from the casing.

7 Remove the stator mounting screws and lift it off, complete with the harness.

Installation

8 Installation is the reverse of the removal procedure, with the following notes.

- Degrease the rotor and crankshaft tapers and remove any metal particles of swarf from the rotor magnet. Remove all traces of gasket from the cover and crankcase mating surfaces.
- Be sure the wiring harness is properly routed and secured with the wire bands.
- The rotor is installed on the crankshaft by aligning its groove with the Woodruff key and sliding it on. Install the mounting bolt and, while keeping the rotor from turning, tighten the bolt to its proper torque.
- Top up the engine oil if work is being carried out with the engine in the frame (see Chapter 1).

20 Oil pan and strainer - removal and installation

Note: The oil pan and strainer can be removed with the engine in the frame. If work is being carried out with the engine removed ignore the preliminary steps.

Removal

- Place the motorcycle on its main stand or an auxiliary stand if no

main stand is fitted. Remove the front cylinder bank exhaust pipes (see Chapter 4). On 1987 and 1988 700/750 Magna models, remove the belly fairing (see Chapter 6). On 1986 through 1988 California models, detach the secondary air supply system air suction valve from the front of the oil pan.

2 Drain the engine oil (see Chapter 1).

3 Remove the nine oil pan bolts and lift off the oil pan. Have a drain pan handy to catch any residual oil.

4 Remove the oil strainer from the oil pump (**see illustration 21.18**).

Installation

5 Clean the strainer thoroughly with solvent and reinstall it on the oil pump, taking care not to displace the sealing ring on its union.

6 While the oil pan is removed, check the operation of the pressure relief valve as described in Section 22.

7 Clean the oil pan interior thoroughly and install it on the engine (if its sealing ring is damaged, replace it with a new one). Install the exhaust pipes, air suction valve and belly fairing (where fitted), then fill the crankcase with the proper amount and grade of oil (see Chapter 1).

21 Oil pump - pressure check, removal, overhaul and installation

Pressure check

1 To check the oil pressure, a suitable gauge and adapter piece (which screws into the oil pressure switch thread) will be needed.

2 Check the oil level (Chapter 1). Warm the engine up to normal operating temperature then stop it.

3 Remove the oil pressure switch as described in Chapter 8.

4 Screw the adapter into the oil pressure switch threads in the top of the crankcase and connect the gauge to the adapter.

5 Start the engine and increase the engine speed to 5000 rpm while watching the gauge reading. The oil pressure should be similar to that given in the Specifications at the start of this Chapter.

6 If the pressure is significantly lower than the standard, either the relief valve is stuck open, the oil pump is faulty, the oil pump pick-up strainer is blocked or there is other engine damage. Begin diagnosis by checking the oil pump pick-up strainer and relief valve, then the oil pump. If those items check out okay, chances are the bearing oil clearances are excessive and the engine needs to be overhauled.

7 If the pressure is too high, the relief valve is stuck closed. To check it, see Section 22.

8 Stop the engine and unscrew the gauge and adapter from the crankcase.

9 Install the oil pressure switch as described in Chapter 8.

Removal

Refer to illustrations 21.15 and 21.18

Note: The oil pump can be removed with the engine in the frame; if the engine has already been removed ignore the steps which don't apply.

10 Drain the engine oil.

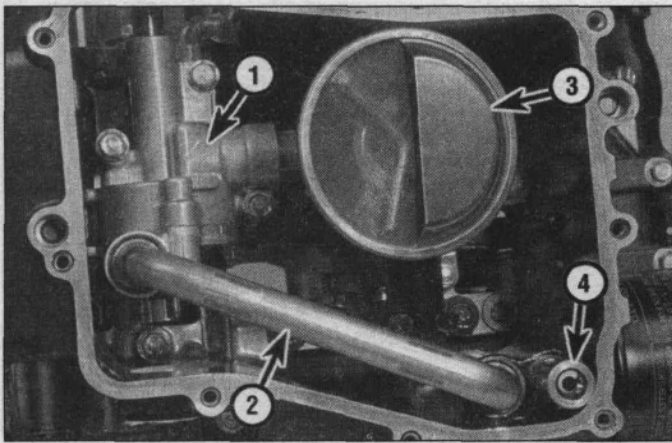
11 Remove the oil pan (see Section 20).

12 On all models remove the rear brake pedal, and on 1100 Magna models also remove the right footpeg.

13 Remove the right crankcase cover bolts. There are two different size bolts, so make a note of their location or store them in the old gasket when this has been removed.

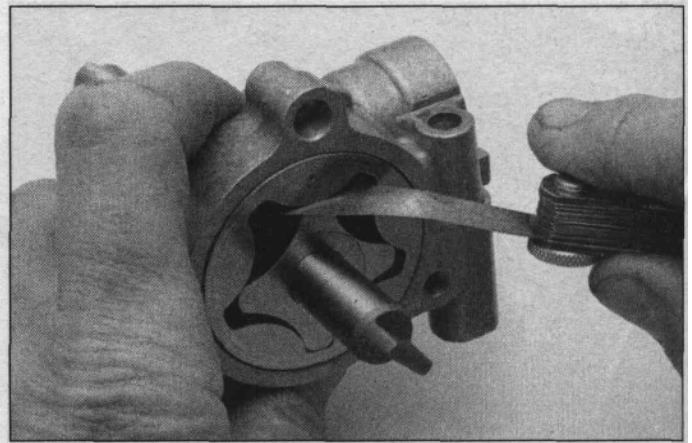
14 Tap the crankcase cover gently with a soft-faced hammer to break the gasket seal, then pull it away from the engine. Do not pry between the gasket sealing surfaces, as damage and eventually oil leaks will occur. Discard the old gasket and remove the dowels for safekeeping in they are loose.

15 Locate the oil pump driven sprocket, directly below the clutch assembly, and remove the sprocket bolt and washer (**see illustration**). Hold the sprocket in place in order to loosen the bolt by inserting a screwdriver through one of the sprocket holes and engaging it in the crankcase opening behind the sprocket (**see illustration 17.4**).

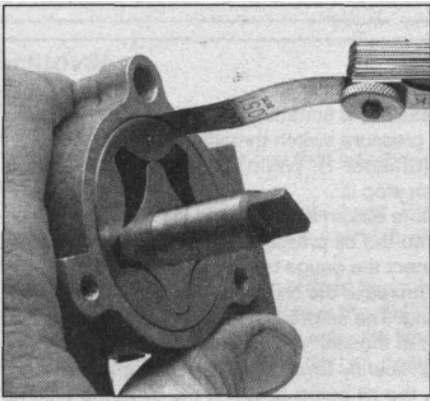


21.18 Oil pan component locations

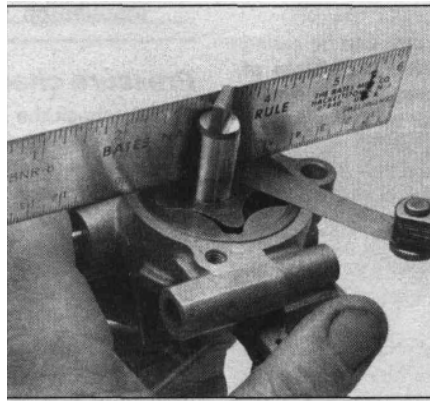
- | | |
|-----------------|-----------------------------|
| 1 Oil pump | 3 Oil strainer |
| 2 Oil pass pipe | 4 Oil pressure relief valve |



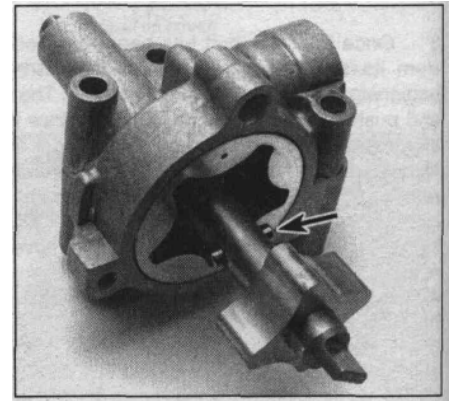
21.26a Measuring oil pump inner-to-outer rotor clearance



21.26b Measuring oil pump outer rotor-to-body clearance



21.26c Use a straightedge and feeler blades to measure rotor end clearance



21.29 Engage inner rotor slots with drive pin (arrow) on installation

- 16 Disengage the sprocket from the chain and remove it.
- 17 Remove the water pump on all models except the 1985 through 1988 700/750 Magna models (see Chapter 3).
- 18 Remove the oil strainer and lift out the oil pass pipe (**see illustration**). Check the condition of the O-rings on both ends of the pass pipe. If they are nicked or damaged, replace them with new ones.
- 19 Remove the oil pump mounting bolts and lift out the pump.
- 20 If the oil pump is to be disassembled, straighten and remove the pin that retains the oil strainer stay to the oil pump. Check the oil strainer stay O-rings for damage and replace them if necessary.

Overhaul

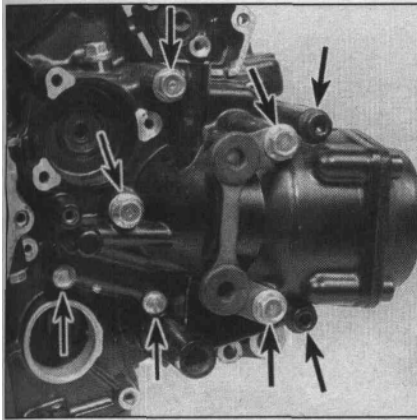
Refer to illustrations 21.26a, 21.26b, 21.26c and 21.29

- 21 Remove the three bolts that secure the oil pump body cover and lift it off. Do not lose the dowel pin.
- 22 Withdraw the rotor shaft and inner rotor from the body and remove the drive pin from the shaft. Separate the inner rotor from the shaft.
- 23 Remove the outer rotor from the body.
- 24 Clean the parts with solvent and dry them thoroughly. If available, use compressed air to blow out all of the passages.
- 25 Check the entire pump body and cover for cracks and evidence of wear. Look closely for a ridge where the rotors contact the body and cover.
- 26 Reassemble the rotors and the shaft in the pump body and use feeler gauges to check the inner rotor-to-outer rotor clearance, the outer rotor-to-pump body clearance and the rotor end clearance (**see**

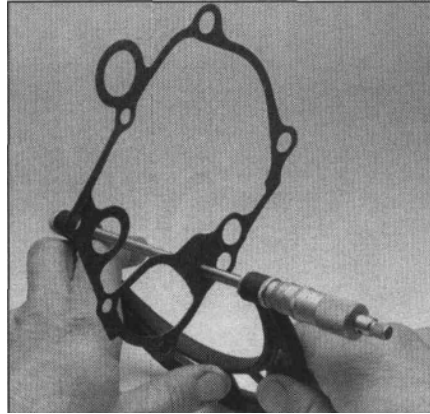
- illustrations).
- 27 If the oil pump clearances are excessive, or if excessive wear is evident, replace the oil pump as a complete unit.
- 28 As the parts are assembled, lubricate them liberally with clean engine oil or grease.
- 29 Install the outer rotor in the pump body. Be sure the indented mark in the rotor faces away from the body. Slip the drive pin through the shaft, then slide the inner rotor onto the shaft and engage the slots in the rotor with the drive pin ends (**see illustration**).
- 30 Insert the shaft through the pump body and mesh the rotors. Install the cover (with the dowel pin in place) and tighten the screws evenly and securely.
- 31 Make sure the pump operates smoothly.

Installation

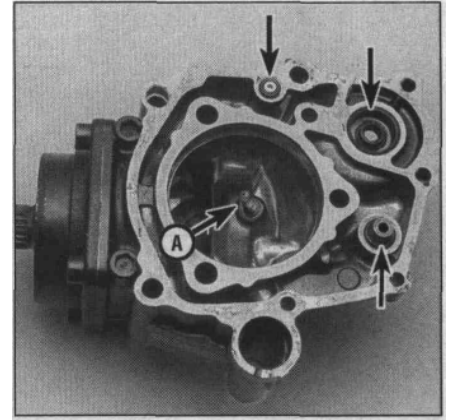
- 32 Installation is the reverse of the removal procedure with the following notes:
 - a) On 1985 through 1988 700/750 Magna models, where the water pump remained in place, mesh the oil pump and water pump driveshaft ends.
 - b) When installing the strainer stay to the oil pump, use a new pin. Also, be sure the O-rings are properly installed on the strainer stay and pass pipe.
 - c) If the oil pump driven sprocket has an IN marking on one of its faces, this must be installed so that it faces the crankcase.
 - d) Following installation, fill the crankcase with the proper amount and grade of new engine oil. Refer to Chapter 1, if necessary.



23.2 Release all eight bolts (arrows) to release output gearcase from crankcase and countershaft bearing holder



23.4 Measuring gearcase gasket thickness (1982 models)



23.5 O-ring and pushrod oil seal positions (arrow). Check that oil nozzle (A) is clear.

22 Oil pressure relief valve - removal, inspection and installation

Note: The pressure relief valve can be removed with the engine in the frame.

Removal

- 1 Remove the oil pan as described in Section 20.
- 2 Pull the oil pressure relief valve out of its location in the crankcase, next to the oil pass pipe (**see illustration 21.18**).

Inspection

3 Push the plunger into the relief valve body and check for free movement. If the valve operation is sticky it must be replaced (apart from the O-ring, individual parts are not available). It is, however, possible to dismantle the valve for cleaning; using snapping pliers, remove the snap-ring from the valve end and withdraw the plain washer, spring and piston from the body.

Installation

- 4 Use a new O-ring on the relief valve body and push it into the crankcase. Install the oil pan (see Section 20).

23 Output gearcase - removal, inspection and installation

Note: The output gear assembly must be removed with the engine out of the frame.

Removal

Refer to illustrations 23.2, 23.4 and 23.5

- 1 Remove the engine from the frame (see Section 5). Release its cover and remove the gearchange/neutral/OD switch and its wiring (see Chapter 8). Remove the water pump (see Chapter 3).
- 2 Remove all eight output gear assembly case bolts, and store them in a cardboard template of the case to ensure they can be returned to their original locations (**see illustration**). This will detach the case from the crankcases and from the output gear bearing housing, leaving the output gear and bearing housing installed on the countershaft.
- 3 Don't pry the output gear case off the crankcase; if it is stubborn, tap it with a soft-faced hammer while simultaneously pulling it off the casing and rotating the output shaft stub to help disengagement of the helical gears. **Caution:** There will be a certain amount of resistance due to the countershaft bearing holder being an interference fit in the

output shaft case - ensure that the output case is withdrawn squarely to prevent the bearing holder tying in the case bore.

4 After removing the gearcase peel off the case gasket; a new one must be fitted on installation. On 1982 models the gasket must be inspected closely for a thickness marking. If marks can be found, be sure to use a new gasket of the same thickness, but if not use a micrometer to measure the thickness of the gasket (**see illustration**). When doing this, be sure the gasket is not torn at the point of measurement and due to the old gasket having been crushed slightly in use, add 0.05 mm (0.002 in) to the measurement to arrive at the required thickness of the replacement. **Note:** Correct gasket thickness is critical to the alignment of the output gears. On all later models only one thickness gasket is available so this check is not necessary.

5 Inspect the condition of the visible O-rings and pushrod oil seal (**see illustration**). If they show any signs of hardening, cracking or other damage they must be replaced. Also check the condition of the gearshift shaft oil seal located at the bottom of the output gearcase gasket surface on the crankcase. Due to its inaccessibility, it is a good idea to replace it at this stage if in an doubt about its condition (the gearshift shaft will have to be removed first - see Section 17).

6 Before disturbing the position of the countershaft, make thin alignment marks with a scribe or white paint across the bearing holder and crankcase as an aid to installation of the output gearcase.

Inspection

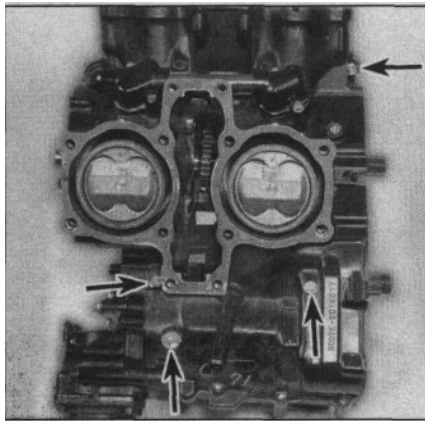
7 Because of the critical nature of the output gear assembly and the number of special tools needed to disassemble, inspect and reassemble it, the assembly should be taken to a Honda dealer if overhaul is required. This applies equally to removal of the helical gear and bearing on the countershaft end, although removal and disassembly of the countershaft gears can be accomplished in the home workshop (see Section 31).

Installation

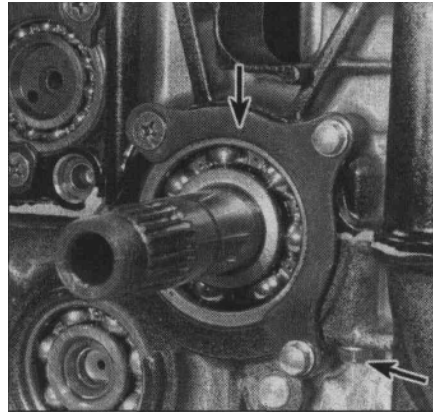
Note: If a new output gearcase or new crankcase, new countershaft or bearing has been installed, the countershaft spacer clearance (endfloat) must be measured and if necessary adjusted, as described in Section 31.

8 Using the marks made on removal, check that the countershaft bearing holder-to-crankcase alignment is correct; this will ensure that the holes line up when the output gearcase is fitted.

9 Fit a new gasket on the crankcase, having selected the correct thickness gasket on 1982 models. Check that the new O-rings and the dowel are in position and make sure any shims found when removing the output gearcase are installed against the bearing holder. Install the output gearcase on the crankcase and tap it squarely onto the bearing holder shoulder using a soft-faced hammer, rotating the output shaft stub to help the helical gears engage.



24.2 Upper crankcase half bolts (arrows)
- rear three bolts have washers under their heads



24.3 Mainshaft bearing retaining plate and hidden crankcase bolt (arrows)



24.10 Do not apply sealant to this area of main bearing mating surfaces

10 Install the gearcase mounting bolts in their original positions and tighten them to the specified torque.

11 Refit the water pump (see Chapter 3), gearchange/neutral/OD switch (see Chapter 8), and engine (see Chapter 5).

24 Crankcase - separation and

reassembly **Separation**

Refer to illustrations 24.2 and 24.3

1 Prior to separating the crankcase halves, the engine must be removed from the frame as described in Section 5 and the following components removed from the engine.

Cylinder heads (Section 10)

Camchain fens/oner guides (Section 8)

Starter clutch (Section 13)

Clutch (Section 14)

Pulse generators (Chapter 4)

Oil pressure switch (Chapter 8)

Alternator rotor and stator (Section 19)

Water pump (Chapters)

Gearchange/neutral/OD switch (Chapter 8)

External gearshift linkage (Section 17)

Starter motor (Chapter 8)

Oil pump (Section 21)

Output gearcase (Section 23)

2 Remove the four upper crankcase bolts (**see illustration**).

3 Remove the mainshaft bearing holder by removing the screw and two bolts. Also remove the crankcase bolt located behind the holder, across the casing joint (**see illustration**).

4 Turn the engine over so it is resting on the upper half of the crankcase and remove the remaining 24 (1987 and 1988 700/750 Magnas) or 28 (all other models) lower crankcase bolts. To prevent distortion of the case, loosen the bolts evenly in a criss-cross pattern for 1987 and 1988 700/750 Magnas, or in a reverse of the tightening sequence for all other models. The bolts are of differing lengths, and some have washers under their heads; make up a cardboard template of the lower crankcase so that the bolts can be stored in their original locations.

5 Gently tap the lower case with a soft-faced hammer to break the seal, then carefully lift it away from the upper case. **Caution:** Do not under any circumstances pry between the cases to separate them as damage to the sealing surfaces will result. If resistance is encountered, double check to make sure that all of the bolts have been removed.

6 To completely strip the crankcase, refer to the following Sections to remove the pistons, connecting rods, crankshaft, transmission shafts and shift drum/forks.

Reassembly

Refer to illustrations 24.10, 24.12a and 24.12b

Note: If new crankcases, or a new output gearcase, countershaft or countershaft bearing have been fitted, the countershaft endfloat must be checked before assembling the case halves (see Section 31).

7 Prior to assembling the crankcase halves, be sure the shift drum and forks, transmission shafts, crankshaft (with camchains), pistons and connecting rods have been installed.

8 Clean the mating surfaces of both crankcase halves with lacquer thinner or acetone.

9 If not done previously, apply molybdenum disulfide grease to the shift fork grooves of the transmission gears.

10 Apply a thin coat of liquid gasket sealant to the mating surfaces of both crankcase halves. **Note:** Do not apply sealant to the area near the main bearings (**see illustration**). Ensure the locating dowel(s) is/are in position.

11 Carefully lower the crankcase half onto the upper crankcase, being sure to align the shift fork claws with the gear fork grooves.

12 With the crankcase halves pressed together, install the lower crankcase bolts, being sure they are installed in their original locations. Tighten the bolts evenly, in two or three steps to the specified torque, noting that the torque differs according to thread diameter. On 1987 and 1988 700/750 Magnas tighten them in a criss-cross pattern, starting with the 9 mm main bearing bolts first; on all other models follow the tightening sequence (**see illustrations**).

13 Turn the engine over so it is resting on the lower crankcase. Install the four upper crankcase bolts, again tightening them evenly and in a criss-cross pattern to their proper torque. **Note:** Where fitted, ensure the plain washers are installed with the three rear bolts.

14 Install the crankcase bolt located behind the mainshaft bearing holder, then install the bearing holder and tighten it securely.

15 When installing the output gearcase, refer to Section 23 for the proper procedure, including new gasket selection on 1982 models.

16 The remainder of the reassembly sequence is the reverse of the dismantling.

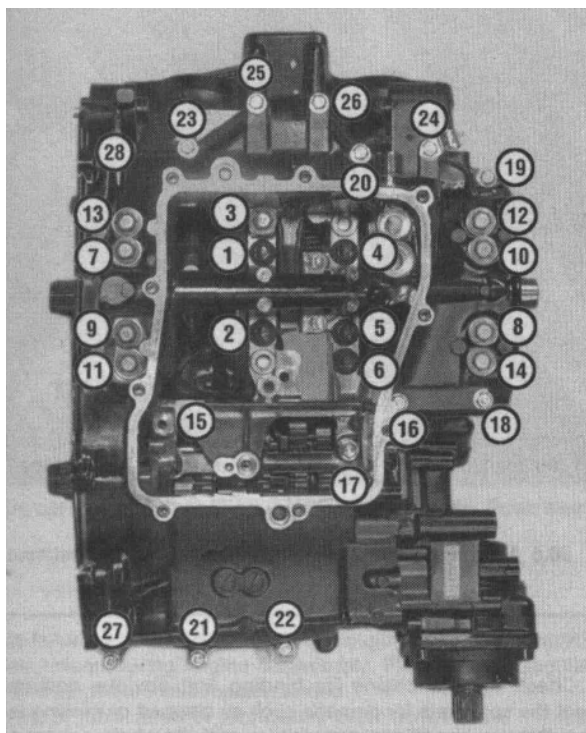
25 Crankcase - inspection and servicing

1 After the crankcases have been separated and the crankshaft and transmission components have been removed, the crankcases should be cleaned thoroughly with new solvent and dried with compressed air.

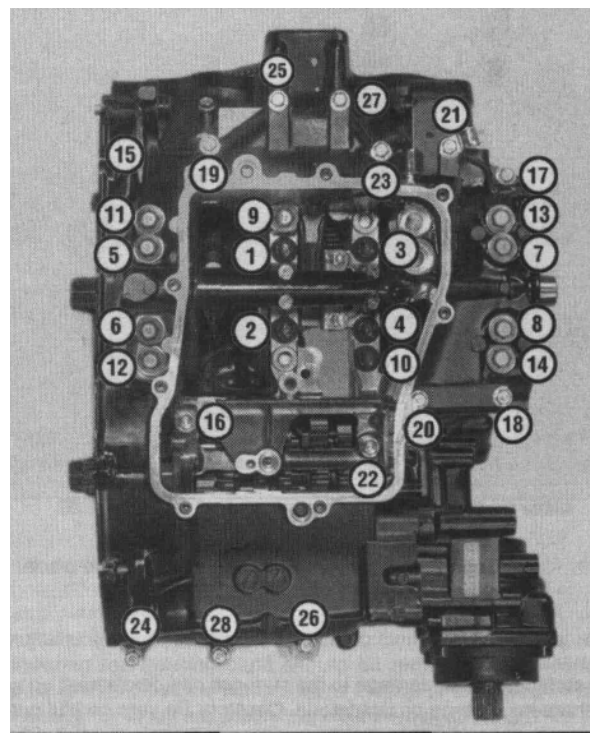
Cylinder bores

Refer to illustration 25.3

Note: Don't attempt to separate the liners from the cylinder block.



24.12a Lower crankcase bolt tightening sequence - 1982 through 1985 700/750 Sabre models, 1982 through 1984 700/750 Magna models, and all 1100 models



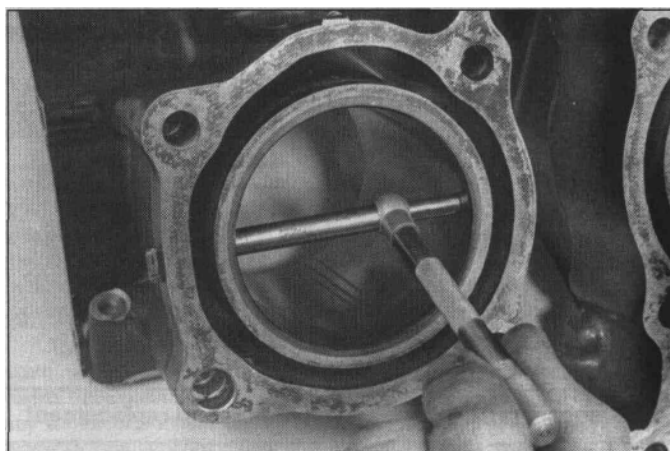
24.12b Lower crankcase bolt tightening sequence - 1985 and 1986 700 Magna models

2 Check the cylinder walls carefully for scratches and score marks.
 3 Using the appropriate precision measuring tools, check each cylinder's diameter (**see illustration**). Measure near the top, center and bottom of the cylinder bore, parallel to the crankshaft axis. Next, measure each cylinder's diameter at the same three locations across the crankshaft axis. Compare the results to this Chapter's Specifications. If the cylinder bores are tapered, out-of-round, worn beyond the specified limits, or badly scuffed or scored, have them rebored and honed by a dealer service department or a motorcycle repair shop. If a rebores is done, oversize pistons and rings will be required as well. Honda produce four sizes of oversize pistons (see Section 29).

4 As an alternative, if the precision measuring tools are not available, a dealer service department or motorcycle repair shop will make the measurements and offer advice concerning servicing of the cylinders.

5 If they are in reasonably good condition and not worn to the outside of the limits, and if the piston-to-cylinder clearances can be maintained properly (see Section 29), then the cylinders do not have to be rebored; honing is all that is necessary.

6 To perform the honing operation you will need the proper size flexible hone with fine stones, or a "bottle brush" type hone, plenty of light oil or honing oil, some shop towels and an electric drill motor. Hold the upper crankcase half in a vise (cushioned with soft jaws or wood blocks) when performing the honing operation. Mount the hone in the drill motor, compress the stones and slip the hone into the top of the cylinder. Lubricate the cylinder thoroughly, turn on the drill and move the hone up and down in the cylinder at a pace which will produce a fine crosshatch pattern on the cylinder wall with the crosshatch lines intersecting at approximately a 60(тыт за цифру занчок бесконечности был) angle. Be sure to use plenty of lubricant and do not take off any more material than is absolutely necessary to produce the desired effect. Do not withdraw the hone from the cylinder while it is running. Instead, shut off the drill and continue moving the hone up and down in the cylinder until it comes to a complete stop, then compress the stones and withdraw the hone. Wipe the oil out of the cylinder and repeat the procedure on the other cylinders. Remember, do not remove too much material from



25.3 Measuring cylinder bore diameter

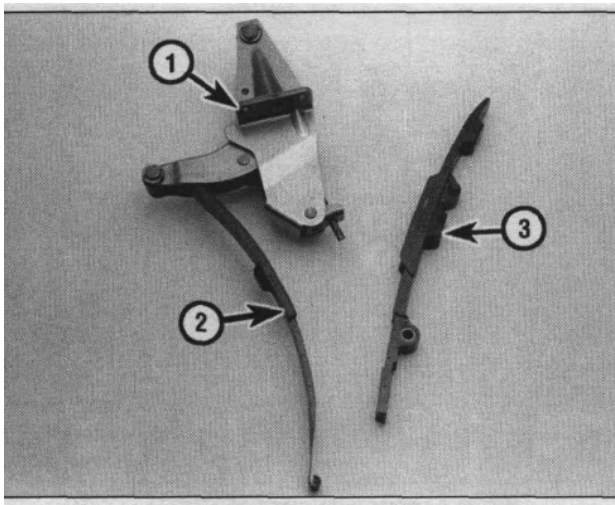
the cylinder wall. If you do not have the tools, or do not desire to perform the honing operation, a dealer service department or motorcycle repair shop will generally do it for a reasonable fee.

7 Next, the cylinders must be thoroughly washed with warm soapy water to remove all traces of the abrasive grit produced during the honing operation. Be sure to run a brush through the bolt holes and flush them with running water. After rinsing, dry the cylinders thoroughly and apply a coat of light, rust-preventative oil to all machined surfaces.

Crankcase castings

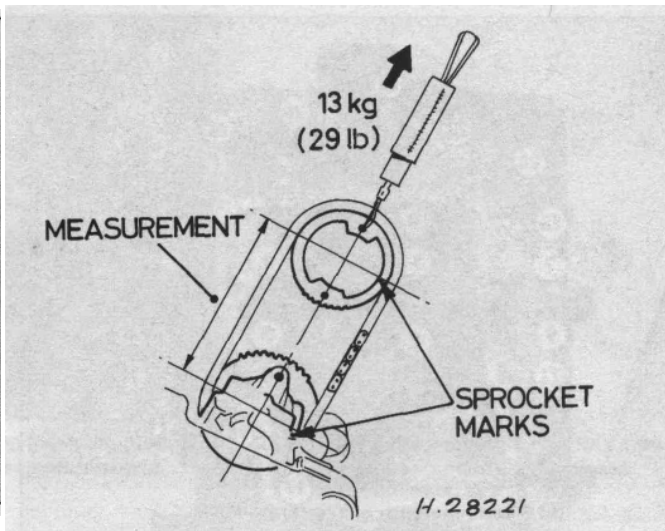
8 Remove any oil passage plugs that haven't already been removed. All oil passages should be blown out with compressed air.

9 All traces of old gasket sealant should be removed from the



26.2 Camchain tensioner components

- | | |
|-----------------|---------------|
| 1 Tensioner | 3 Guide blade |
| 2 Slipper blade | |



26.5 Measuring camchain stretch with a spring balance

mating surfaces. Minor damage to the surfaces can be cleaned up with a fine sharpening stone or grindstone. **Caution:** Be very careful not to nick or gouge the crankcase mating surfaces or leaks will result. Check both crankcase halves very carefully for cracks and other damage.

10 Small cracks or holes in aluminum castings may be repaired with an epoxy resin adhesive as a temporary measure. Permanent repairs can only be effected by argon-arc welding, and only a specialist in this process is in a position to advise on the economy or practical aspect of such a repair. If any damage is found that can't be repaired, replace the crankcase halves as a set.

11 Damaged threads can be economically reclaimed by using a diamond section wire insert, of the Helicoil type, which is easily fitted after drilling and re-tapping the affected thread. Most motorcycle dealers and small engineering firms offer a service of this kind.

12 Sheared studs or screws can usually be removed with screw extractors, which consist of a tapered, left thread screws of very hard steel. These are inserted into a pre-drilled hole in the stud, and usually succeed in dislodging the most stubborn stud or screw. If a problem arises which seems beyond your scope, it is worth consulting a professional engineering firm before condemning an otherwise sound casing. Many of these firms advertise regularly in the motorcycle press.

26 Camchains and guides - inspection and

replacement **Camchain tensioner, guides and**

slipper blades

Note: The camchain tensioner, guides and tensioner slipper blades can be removed with the engine in the frame (see Section 8). Refer to illustration 26.2

1 Check for smooth operation of the tensioner, that its spring is unbroken and that there is no wear at any of the tensioner arm or body pivots.

2 Check the guides for deep grooves, cracking and other obvious damage, replacing them if necessary (see illustration).

Camchains

Note: The engine must be removed from the frame and the crankcase halves separated to remove the camchains. Refer to illustration 26.5

3 Remove the cylinder heads and separate the crankcase halves (see Sections 10 and 24). The camchains can then be slipped off the crankshaft sprockets.

4 Check the camchains for binding and obvious damage and inspect the sprockets for damage such as chipped or missing teeth. If either of these conditions are visible, or if the chain appears to be stretched, both chains and sprockets (crankshaft and both camshaft sprockets) should be replaced as a set.

5 With the use of a spring balance it is possible to measure the amount of chain stretch and compare it with the service limit (see Specifications) to determine whether it needs replacing. With the chain around the sprocket of one camshaft secured in the cylinder head, install the other sprocket in the chain loop and use apply a force of 13 kg (26 lbs) on the spring balance (hooked through the outer sprocket bolt hole). Measure the distance between the sprocket centers or between the sprocket alignment marks (see illustration).

6 Installation is a reverse of the removal procedure.

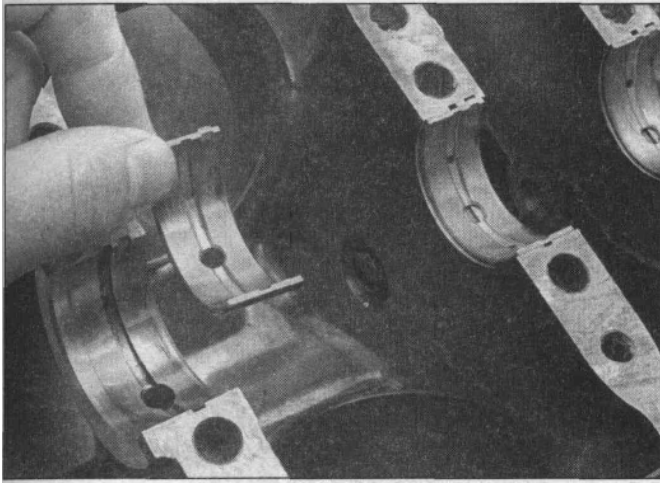
27 Main and connecting rod bearings - general note

1 Even though main and connecting rod bearings are generally replaced with new ones during the engine overhaul, the old bearings should be retained for close examination as they may reveal valuable information about the condition of the engine.

2 Bearing failure occurs mainly because of lack of lubrication, the presence of dirt or other foreign particles, overloading the engine and/or corrosion. Regardless of the cause of bearing failure, it must be corrected before the engine is reassembled to prevent it from happening again.

3 When examining the bearings, remove the main bearings from the case halves and the rod bearings from the connecting rods and caps and lay them out on a clean surface in the same general position as their location on the crankshaft journals. This will enable you to match any noted bearing problems with the corresponding crankshaft journal.

4 Dirt and other foreign particles get into the engine in a variety of ways. It may be left in the engine during assembly or it may pass through filters or breathers. It may get into the oil and from there into the bearings. Metal chips from machining operations and normal engine wear are often present. Abrasives are sometimes left in engine components after reconditioning operations such as cylinder honing, especially when parts are not thoroughly cleaned using the proper cleaning methods. Whatever the source, these foreign objects often end up imbedded in the soft bearing material and are easily recognized. Large particles will not imbed in the bearing and will score or gouge the bearing and journal. The best prevention for this cause of



28.4 Be careful when handling main bearing inserts. Push them to one side to release from casing

bearing failure is to clean all parts thoroughly and keep everything spotlessly clean during engine reassembly. Frequent and regular oil and filter changes are also recommended.

5 Lack of lubrication or lubrication breakdown has a number of interrelated causes. Excessive heat (which thins the oil), overloading (which squeezes the oil from the bearing face) and oil leakage or throw off from excessive bearing clearances, worn oil pump or high engine speeds all contribute to lubrication breakdown. Blocked oil passages will also starve a bearing and destroy it. When lack of lubrication is the cause of bearing failure, the bearing material is wiped or extruded from the steel backing of the bearing. Temperatures may increase to the point where the steel backing and the journal turn blue from overheating.

6 Riding habits can have a definite effect on bearing life. Full throttle low speed operation, or lugging (labouring) the engine, puts very high loads on bearings, which tend to squeeze out the oil film. These loads cause the bearings to flex, which produces fine cracks in the bearing face (fatigue failure). Eventually the bearing material will loosen in pieces and tear away from the steel backing. Short trip riding leads to corrosion of bearings, as insufficient engine heat is produced to drive off the condensed water and corrosive gases produced. These products collect in the engine oil, forming acid and sludge. As the oil is carried to the engine bearings, the acid attacks and corrodes the bearing material.

7 Incorrect bearing installation during engine assembly will lead to bearing failure as well. Tight fitting bearings which leave insufficient bearing oil clearances result in oil starvation. Dirt or foreign particles trapped behind a bearing insert result in high spots on the bearing which lead to failure.

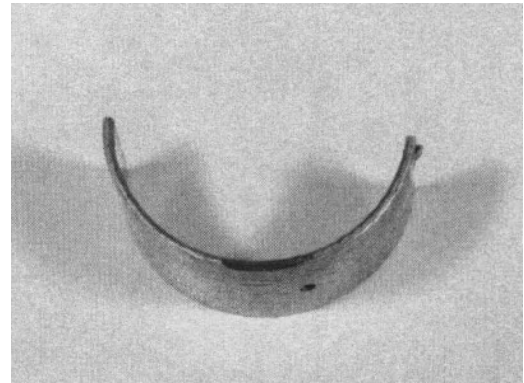
8 To avoid bearing problems, clean all parts thoroughly before reassembly, double check all bearing clearance measurements and lubricate the new bearings with clean engine oil during installation.

28 Crankshaft and main bearings - removal, inspection, bearing selection, oil clearance check and installation

Removal

Refer to illustration 28.4

- 1 Separate the crankcase halves as described in Section 24.
- 2 Remove the piston/connecting rod assemblies as described in Section 29. **Note:** If no work is to be carried out on the piston/connecting rod assemblies there is no need to remove them from the bores. The cylinder heads can be left in position although the



28.9 Bearing inserts are color-coded on their sides

camchains should be detached from the camshaft sprockets, and the connecting rod bearing caps should be removed (see Section 29, Steps 2 and 3). Push the pistons up to the top of the bores so that the connecting rod ends are positioned clear of the crankshaft.

3 Lift the crankshaft out of the upper crankcase half, taking care not to dislodge the bearing inserts.

4 The main bearing inserts can be removed from the crankcase halves by pushing their centers to the side, then lifting them out (**see illustration**). Keep the bearing inserts in order.

Inspection

5 Clean the crankshaft with solvent, using a rifle-cleaning brush to scrub out the oil passages. If available, blow the crank dry with compressed air.

6 Refer to Section 27 and examine the main bearing inserts. If they are scored, badly scuffed or appear to have been seized, new bearings must be installed. Always replace the main bearings as a set. If they are badly damaged, check the corresponding crankshaft journal. Evidence of extreme heat, such as discoloration, indicates that lubrication failure has occurred. Be sure to thoroughly check the oil pump and pressure relief valve as well as all oil holes and passages before reassembling the engine.

7 The crankshaft journals should be given a close visual examination, paying particular attention where damaged bearing inserts have been discovered. If the journals are scored or pitted in any way a new crankshaft will be required. Note that undersizes are not available, precluding the option of re-grinding the crankshaft.

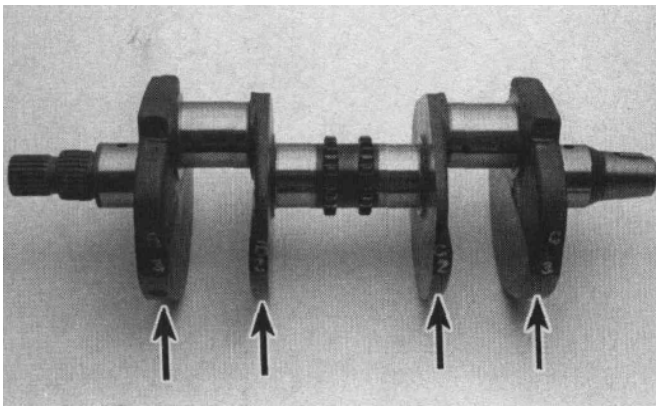
8 Set the crankshaft on V-blocks and check the runout with a dial indicator touching the center main bearing journal, comparing your findings with this Chapter's Specifications. If the runout exceeds the limit, replace the crank.

Bearing selection

Refer to illustrations 28.9, 28.10 and 28.11

9 The main bearing running clearance is controlled in production by selecting one of five (700/750 models) or three (1100 models) grades of bearing insert. The grades are indicated by a color-coding marked on the edge of each insert (**see illustration**). In order, from the thickest to the thinnest, the insert grades are: Black, Blue, Brown, Green and Yellow for 700/750 models and Brown, Green and Yellow for 1100 models. New bearing inserts are selected as follows using the crankshaft journal and crankcase main bearing bore size markings.

10 The standard crankshaft journal diameter is divided into size groups to allow for manufacturing tolerances. The size group of each journal can be determined by the numbers (1, 2 or 3 on 700/750



28.10 Location of main bearing journal size codes (arrows) - also connecting rod journal sizes

models and 1 or 2 on 1100 models) which are stamped on each crank web (**see illustration**). **Note:** Ignore the letters as these refer to the crankpin journals. The numbers indicate the diameter of the crankshaft journal immediately outboard of that web. If the equipment is available, these marks can be checked by direct measurement.

11 The crankcase main bearing bore diameters are also divided into size groups to allow for manufacturing tolerances. The size group of each main bearing bore can be determined using the four codes stamped on the rear outside face of the upper crankcase half (**see illustration**). These will be made up of the letters A, B or C on 700/750 models and I and II or 1 and 2 on 1100 models. The first letter indicates the diameter of the left journal, and the last the diameter of the right journal. If the equipment is available, these marks can be checked by direct measurement.

12 Match the relevant crankcase code with its crankshaft code and select a new set of bearing inserts using the following table.

700/750 models

Crank web mark	Case mark	Insert color
1	A	Yellow 1
B	Green 1	C
Brown 2	A	Green 2
B	Brown 2	C
Black 3	A	Brown 3
B	Black 3	C
Blue		

1100cc models

Crank web mark	Case mark	Insert color
1	I or 1	Yellow 1
II or 2	Green 2	I or 1
Green 2	II or 2	Brown

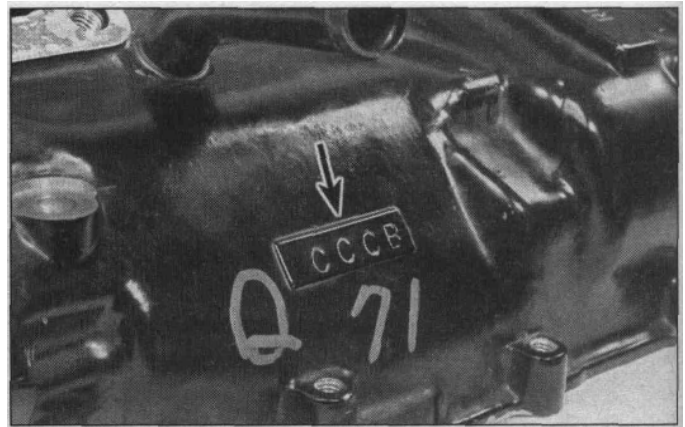
Oil clearance check

13 Whether new bearing inserts are being fitted or the original ones are being re-used, the main bearing oil clearance should be checked prior to reassembly.

14 Clean the backs of the bearing inserts and the bearing locations in both crankcase halves.

15 Press the bearing inserts into their locations, ensuring that the tab on each insert engages in the notch in the crankcase. Make sure the bearings are fitted in the correct locations and take care not to touch any insert's bearing surface with your fingers.

16 There are two possible ways of checking the oil clearance, the first method is by direct measurement (see Step 17 and 23) and the second by the use of a product known as Plastigage (see Steps 18 to 23).



28.11 Main bearing bore diameter codes are stamped in upper crankcase half (arrow)

17 If the first method is to be used, with the main bearing inserts in position, carefully lower the lower crankcase half onto the upper half. Make sure that the shift forks (if fitted) engage with their respective slots in the countershaft gears as the halves are joined. Check that the lower crankcase half is correctly seated. **Note:** Do not tighten the crankcase bolts if the casing is not correctly seated. Install all the lower crankcase bolts and following the correct tightening sequence (see Section 24) tighten them to the specified torque. Measure the internal diameter of each assembled pair of bearing inserts. If the diameter of each corresponding crankshaft journal is measured and then subtracted from the bearing internal diameter, the result will be the connecting rod bearing oil clearance.

18 If the second method is to be used, ensure the main bearing inserts are correctly fitted and that the inserts and crankshaft are clean and dry. Lay the crankshaft in position in the upper crankcase.

19 Cut several lengths of the appropriate size Plastigage (they should be slightly shorter than the width of the crankshaft journal). Place a strand of Plastigage on each (cleaned) crankshaft journal, avoiding the oilway.

20 Carefully lower the lower crankcase half onto the upper half. Make sure that the shift forks (if fitted) engage with their respective slots in the countershaft gears as the halves are joined. Check that the lower crankcase half is correctly seated. **Note:** Do not tighten the crankcase bolts if the casing is not correctly seated and make sure the crankshaft is not rotated as the bolts are tightened. Install all the lower crankcase bolts and following the correct tightening sequence (see Section 24) tighten them to the specified torque.

21 Loosen and remove the crankcase bolts in a reverse of the tightening sequence, making sure the Plastigage is not disturbed.

22 Compare the width of the crushed Plastigage on each crankshaft journal to the scale printed on the Plastigage envelope to obtain the main bearing oil clearance (**see illustration 29.37**).

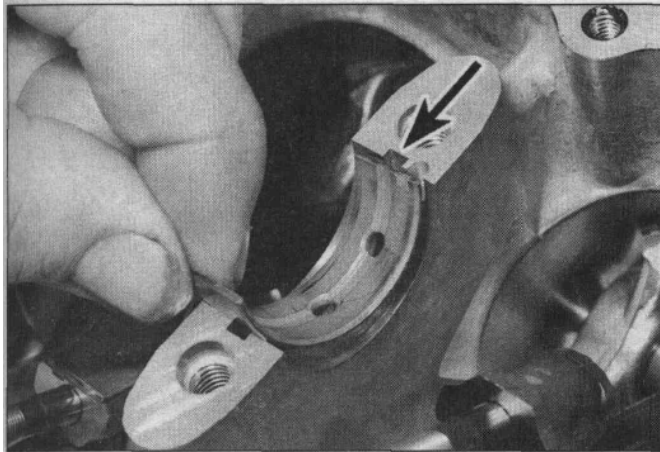
23 If the clearance is not within the specified limits, the bearing inserts may be the wrong grade (or excessively worn if the original inserts are being re-used). Before deciding that different grade inserts are needed, make sure that no dirt or oil was trapped between the bearing inserts and the crankcase halves when the clearance was measured. If the clearance is excessive, even with new inserts (of the correct size), the crankshaft journal is worn and the crankshaft should be replaced.

24 On completion carefully scrape away all traces of the Plastigage material from the crankshaft journal and bearing inserts; use a fingernail or other object which is unlikely to score the inserts.

Installation

Refer to illustrations 28.26 and 28.27

25 Clean the backs of the bearing inserts and the bearing recesses in both crankcase halves. If new inserts are being fitted, ensure that all traces of the protective grease are cleaned off using kerosene



28.26 Ensure locating tab engages cutout (arrow) when installing main bearing inserts

(paraffin). Wipe dry the inserts and crankcase halves with a lint-free cloth.

26 Press the bearing inserts into their locations. Make sure the tab on each insert engages in the notch in the casing (**see illustration**). Make sure the bearings are fitted in the correct locations and take care not to touch any insert's bearing surface with your fingers.

27 Lubricate the bearing inserts in the upper crankcase with clean engine oil (**see illustration**).

28 Lower the crankshaft into position in the upper crankcase.

29 Fit the piston/connecting rod assemblies to the crankshaft as described in Section 29 if they were disconnected.

30 Reassemble the crankcase halves as described in Section 24.

29 Piston/connecting rod assemblies - removal, inspection, bearing selection, oil clearance check and installation

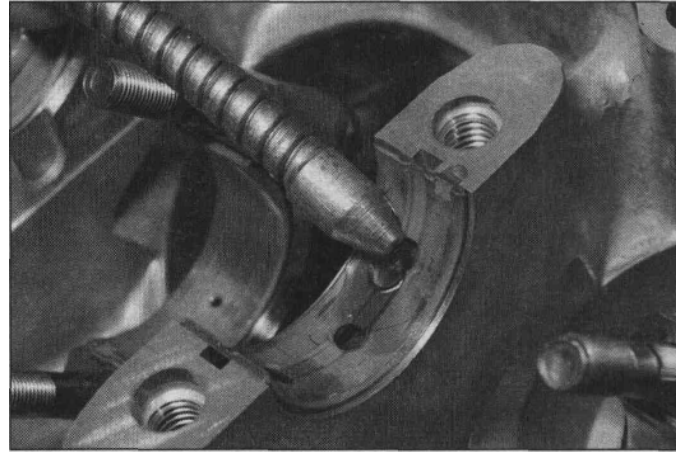
Removal

Refer to illustrations 29.1 and 29.8

1 Separate the crankcase halves as described in Section 24. Before removing the piston/connecting rods from the crankshaft measure the side clearance of each rod with a feeler gauge (**see illustration**). If the clearance on any rod is greater than the service limit listed in this Chapter's Specifications, that rod will have to be replaced with a new one.



29.1 Measuring connecting rod side clearance



28.27 Oil insert liberally before crankshaft is installed

2 Using a center punch or paint, mark the relevant cylinder number on each connecting rod and bearing cap (see illustration 1.1 at the beginning of this Chapter).

3 Unscrew the bearing cap nuts and withdraw the cap, complete with the lower bearing insert, from each of the four connecting rods. Push the connecting rods up and off their crankpins, then remove the upper bearing insert. Keep the cap, nuts and (if they are to be re-used) the bearing inserts together in their correct sequence.

4 Remove the ridge of carbon from the top of each cylinder bore. If there is a pronounced wear ridge at the top of each bore, remove it with a ridge reamer.

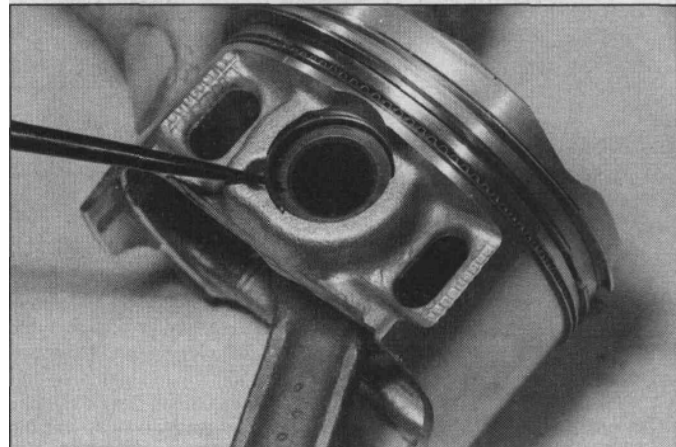
5 Push each piston/connecting rod assembly up and remove it from the top of the bore making sure the connecting rod does not mark the cylinder bore walls. **Caution:** Do not try to remove the piston/connecting rod from the bottom of the cylinder bore. The piston will not pass the crankcase main bearing webs. If the piston is pulled right to the bottom of the bore the oil control ring will expand and lock the piston in position. If this happens it is likely the ring will be broken.

6 Immediately install the relevant bearing cap, inserts and nuts on each piston/connecting rod assembly so that they are all kept together as a matched set.

7 Using a sharp scriber, scratch the number of each piston into its crown (or use a suitable marker pen if the piston is clean enough).

8 Support the first piston and, using a small screwdriver or scriber, carefully pry out a circlip from the piston groove (**see illustration**).

9 Push the piston pin out from the opposite end to free the piston from the rod. You may have to deburr the area around the groove to



29.8 Pry out the circlip from the piston groove



29.11 Use a ring removal and installation tool to remove top and second piston rings

enable the pin to slide out (use a triangular file for this procedure). If the pin is tight, tap it out using a suitable hammer and punch, taking care not to damage the piston. Repeat the procedure for the other pistons.

Inspection

Refer to illustrations 29.11, 29.18, 29.19, 29.20a, 29.20b and 29.23

Pistons

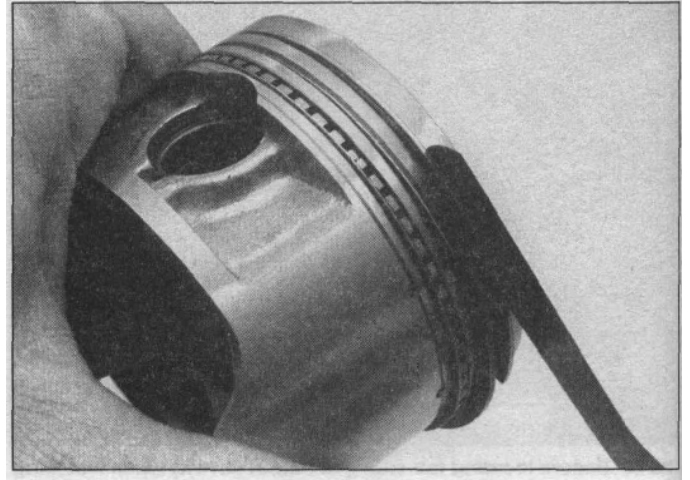
10 Before the inspection process can be carried out, the pistons must be cleaned and the old piston rings removed.

11 Using a piston ring removal and installation tool, carefully remove the rings from the pistons (**see illustration**). Do not nick or gouge the pistons in the process.

12 Scrape all traces of carbon from the tops of the pistons. A hand-held wire brush or a piece of fine emery cloth can be used once most of the deposits have been scraped away. Do not, under any circumstances, use a wire brush mounted in a drill motor to remove deposits from the pistons; the piston material is soft and will be eroded away by the wire brush.

13 Use a piston ring groove cleaning tool to remove any carbon deposits from the ring grooves. If a tool is not available, a piece broken off an old ring will do the job. Be very careful to remove only the carbon deposits. Do not remove any metal and do not nick or gouge the sides of the ring grooves.

14 Once the deposits have been removed, clean the pistons with solvent and dry them thoroughly. Make sure the oil return holes below



29.18 Measuring piston ring-to-groove clearance

the oil ring grooves are clear.

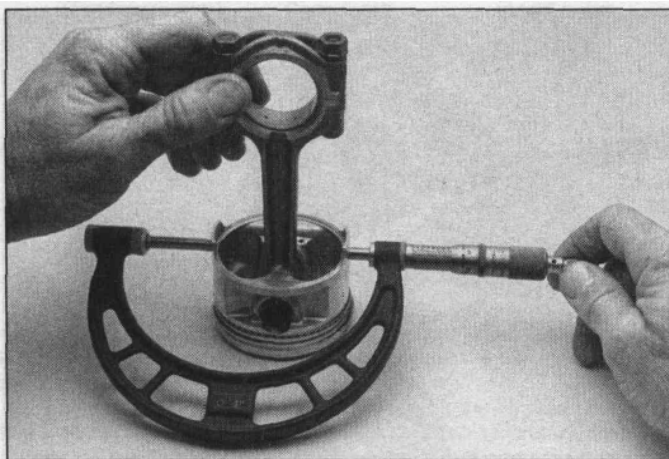
15 If the pistons are not damaged or worn excessively and if the cylinders are not to be rebored, new pistons will not be necessary. Normal piston wear appears as even, vertical wear on the thrust surfaces of the piston and slight looseness of the top ring in its groove. New piston rings, on the other hand, should always be used when an engine is rebuilt.

16 Carefully inspect each piston for cracks around the skirt, at the pin bosses and at the ring lands.

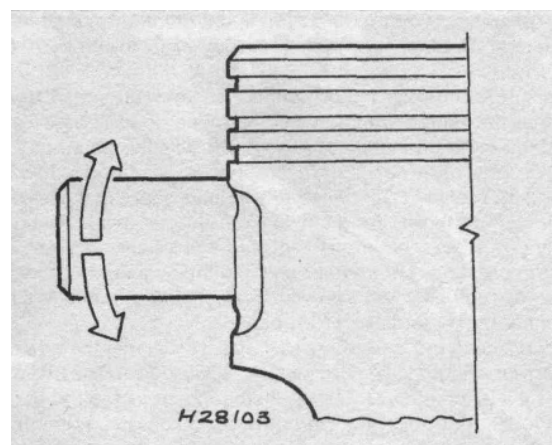
17 Look for scoring and scuffing on the thrust faces of the skirt, holes in the piston crown and burned areas at the edge of the crown. If the skirt is scored or scuffed, the engine may have been suffering from overheating and/or abnormal combustion, which caused excessively high operating temperatures. The oil pump should be checked thoroughly. A hole in the piston crown, an extreme to be sure, is an indication that abnormal combustion (pre-ignition) was occurring. Burned areas at the edge of the piston crown are usually evidence of spark knock (detonation). If any of the above problems exist, the causes must be corrected or the damage will occur again.

18 Measure the piston ring-to-groove clearance by laying a new piston ring in the ring groove and slipping a feeler gauge in beside it (**see illustration**). Check the clearance at three or four locations around the groove. Be sure to use the correct ring for each groove; they are different. If the clearance is greater than the service limit, new pistons will have to be used when the engine is reassembled.

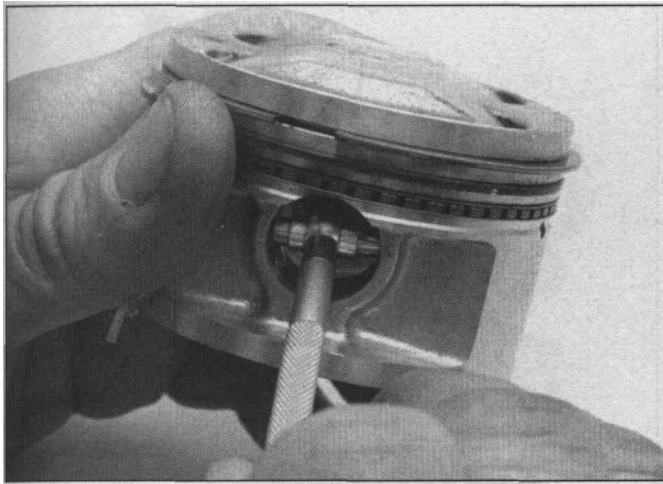
19 Calculate the piston-to-bore clearance by measuring the bore



29.19 Measuring piston diameter



29.20a Rock piston pin in piston boss to check for wear .



29.20b ... or check by direct measurement

(see Section 25) and the piston diameter. Make sure that the pistons and cylinders are correctly matched. Measure the piston across the skirt on the thrust faces at a 90° angle to the piston pin, 11 mm (1/2 inch) up from the bottom of the skirt (**see illustration**). Subtract the piston diameter from the bore diameter to obtain the clearance. If it is greater than specified, the cylinders will have to be rebored and new oversized pistons and rings installed.

20 Apply clean engine oil to the pin, insert it into the piston and check for freeplay by rocking the pin back-and-forth (**see illustration**). If the pin is loose, new pistons and pins must be installed. If the necessary measuring equipment is available measure the pin diameter and piston pin bore and check the readings obtained do not exceed the limits given in this Chapter's Specifications (**see illustration**). Replace components that are worn beyond the specified limit.

21 If the pistons are to be replaced, ensure the correct size of piston is ordered. Honda produce four oversizes of piston as well as standard pistons. The piston oversizes available are: +0.25 mm, +0.50 mm, +0.75 mm and +1.0 mm. **Note:** Oversize pistons have their relevant size stamped on top of the piston crown, eg. a 0.25 mm oversize piston will be marked 0.25.

22 Install the rings on the pistons as described in Section 30.

Connecting rods

23 Check the connecting rods for cracks and other obvious damage. Lubricate the piston pin for each rod, install it in its original rod and check for play (**see illustration**). If it wobbles, replace the connecting rod and/or the pin. If the necessary measuring equipment is available measure the pin diameter and connecting rod bore and check the readings obtained do not exceed the limits given in this Chapter's Specifications. Replace components that are worn beyond the specified limit.

24 Refer to Section 27 and examine the connecting rod bearing inserts. If they are scored, badly scuffed or appear to have been seized, new bearings must be installed. Always replace the bearings in the connecting rods as a set. If they are badly damaged, check the corresponding crankpin. Evidence of extreme heat, such as discoloration, indicates that lubrication failure has occurred. Be sure to thoroughly check the oil pump and pressure relief valve as well as all oil holes and passages before reassembling the engine.

25 Have the rods checked for twist and bending at a dealer service department or other motorcycle repair shop.

26 If a connecting rod is to be replaced, it is essential that the new rod is of the correct weight group to minimize vibration. The weight is indicated by a letter (A, B, C, D or E) stamped across the rod and cap join. This letter together with the connecting rod size number (see Step 29) should be quoted when purchasing new connecting rod(s). **Note:** When ordering a new connecting rod also provide the dealer with the markings for the opposite cylinder's rod on that journal.



29.23 Checking for play between piston pin and connecting rod small-end

Bearing selection

Refer to illustration 29.29

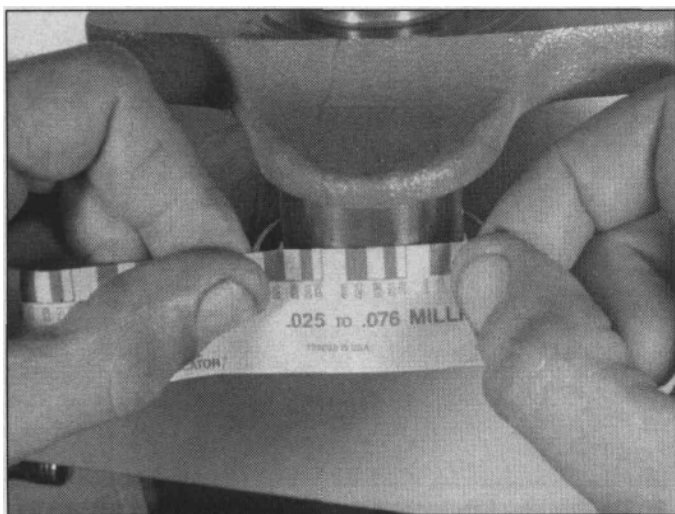
27 The connecting rod bearing running clearance is controlled in production by selecting one of five (700/750 models) or three (1100 models) grades of bearing insert. The grades are indicated by a color-coding marked on the edge of each insert (**see illustration 28.9**). In order, from the thickest to the thinnest, the insert grades for 700/750 models are: Blue, Black, Brown, Green and Yellow and for 1100 models are Brown, Green and Yellow. New bearing inserts are selected as follows using the crankpin and connecting rod size markings.

28 The standard crankpin journal diameter is divided into size groups to allow for manufacturing tolerances. The size group of each crankpin can be determined by the letters (700/750 models: A, B or C, 1100 models: A or B) stamped on the edge of each crank web (**see illustration 28.10**). **Note:** Ignore the numbers as these refer to the main bearing journals. Each letter indicates the diameter of each crankpin immediately inboard of that web. If the equipment is available, these marks can be checked by direct measurement.

29 The connecting rods are also divided into size groups to allow for manufacturing tolerances. The size group is in the form of numbers (700/750 models: 1, 2 or 3, 1100 models: 1 or 2) (**see illustration**). **Note:** Ignore the letter as this indicates the weight group of the connecting rod. If the equipment is available, these marks can be



29.29 Connecting rod bearing bore size group and weight marking (arrow)



29.37 Measure the crushed Plastigage to arrive at the connecting rod bearing oil clearance

checked by direct measurement.

30 Match the relevant connecting rod code with its crankshaft code and select a new set of bearing inserts using the following table.

700/750 models

Rod mark	Crank web mark	Insert color
1	A	Yellow
1	B	Green
1	C	Brown
2	A	Green
2	B	Brown
2	C	Black
3	A	Brown
3	B	Black
3	C	Blue

1100 models

Rod mark	Crank web mark	Insert color 1
A	Yellow 1	B
Green 2	A	Green 2
B	Brown	

Oil clearance check

Refer to illustration 29.37

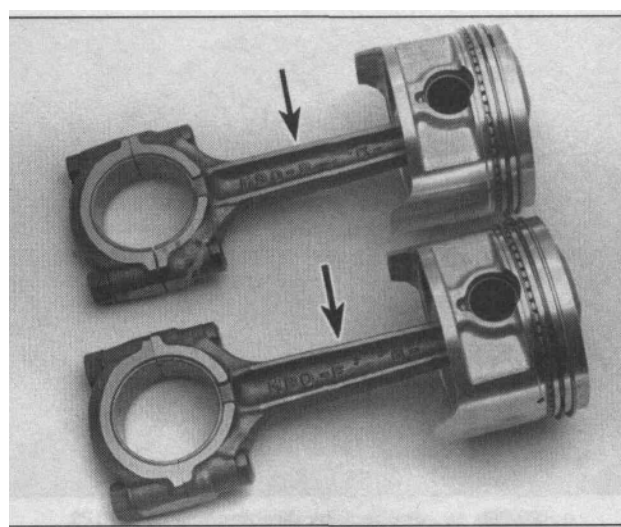
31 Whether new bearing inserts are being fitted or the original ones are being re-used, the connecting rod bearing oil clearance should be checked prior to reassembly.

32 Clean the backs of the bearing inserts and the bearing locations in both the connecting rod and bearing cap.

33 Press the bearing inserts into their locations, ensuring that the tab on each insert engages in the notch in the connecting rod/bearing cap. Make sure the bearings are fitted in the correct locations and take care not to touch any insert's bearing surface with your fingers.

34 There are two possible ways of checking the oil clearance, the first method is by direct measurement (see Steps 35 and 38) and the second by the use of a product known as Plastigage (see Steps 36 to 38).

35 If the first method is to be used, fit the bearing cap to the connecting rod, with the bearing inserts in place. Make sure the cap is fitted the correct way around so the connecting rod and bearing cap weight/size markings are correctly aligned. Tighten the cap retaining nuts to the specified torque and measure the internal diameter of each assembled pair of bearing inserts. If the diameter of each



29.40 Connecting rod identification markings (arrows)

corresponding crankpin journal is measured and then subtracted from the bearing internal diameter, the result will be the connecting rod bearing oil clearance.

36 If the second method is to be used, cut several lengths of the appropriate size Plastigage (they should be slightly shorter than the width of the crankpin). Place a strand of Plastigage on each (cleaned) crankpin journal and fit the (clean) piston/connecting rod assemblies, inserts and bearing caps. Make sure the cap is fitted the correct way around so the connecting rod and bearing cap weight/size markings are correctly aligned and tighten the bearing cap nuts to the specified torque while ensuring that the connecting rod does not rotate. Take care not to disturb the Plastigage. Loosen the bearing cap nuts and remove the connecting rod assemblies, again taking great care not to rotate the crankshaft.

37 Compare the width of the crushed Plastigage on each crankpin to the scale printed on the Plastigage envelope to obtain the connecting rod bearing oil clearance (**see illustration**).

38 If the clearance is not within the specified limits, the bearing inserts may be the wrong grade (or excessively worn if the original inserts are being re-used). Before deciding that different grade inserts are needed, make sure that no dirt or oil was trapped between the bearing inserts and the connecting rod or bearing cap when the clearance was measured. If the clearance is excessive, even with new inserts (of the correct size), the crankpin is worn and the crankshaft should be replaced.

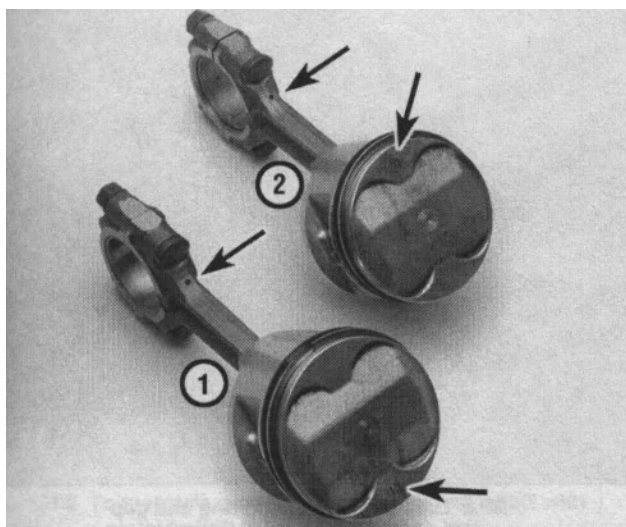
39 On completion carefully scrape away all traces of the Plastigage material from the crankpin and bearing inserts using a fingernail or other object which is unlikely to score the inserts.

Installation

Refer to illustration 29.40, 29.41, 29.44 and 29.47

40 Check that each piston has one new snap-ring fitted to it and insert the piston pin from the opposite side. If it is a tight fit, the piston should be warmed first. If the original pistons/connecting rods are being installed, use the marks made on disassembly to ensure each piston is fitted to its correct connecting rod (**see illustration**). **Note:** The front cylinder connecting rods are marked MBO-F or MBI-F on 700/750 models and MB4-F on 1100 models; the rear cylinder rods are similarly marked, but carry the letter R.

41 Lubricate the piston pin and connecting rod bores with clean engine oil and fit each piston to its respective connecting rod making sure that the IN mark on the crown of the piston is on the opposite side to the connecting rod oilway on front cylinder pistons, and on the same side as the oilway on rear cylinder pistons (**see illustration**). When the



29.41 Piston crown IN marking to connecting rod oilway relationship

1 Front cylinder rods

2 Rear cylinder rods

pistons are installed in their bores, the IN marks on their crowns should be on the carburetor side (toward the inside of the V formed by the cylinders).

42 Push the piston pin through both piston bosses and the connecting rod bore. If necessary the pin can be tapped carefully into position, using a hammer and suitable drift, while supporting the connecting rod and piston. Secure each piston pin in position with a second new snap-ring, making sure it is correctly seated in the piston groove.

43 Clean the backs of the bearing inserts and the bearing recesses in both the connecting rod and bearing cap. If new inserts are being fitted, ensure that all traces of the protective grease are cleaned off using kerosene (paraffin). Wipe dry the inserts and connecting rods with a lint-free cloth.

44 Press the bearing inserts into their locations, aligning the oilway in the insert with the corresponding oilway in the connecting rod. Make sure the tab on each insert engages in the notch in the connecting rod or bearing cap (**see illustration**). Make sure the bearings are fitted in the correct locations and take care not to touch any insert's bearing surface with your fingers.

45 Lubricate the cylinder bores, the pistons and piston rings then lay out each piston/connecting rod assembly in its respective position.

46 Starting with assembly number 1, position the top and second ring end gaps so they are 120° apart then position the oil control ring side rails so that their end gaps are 120° apart.

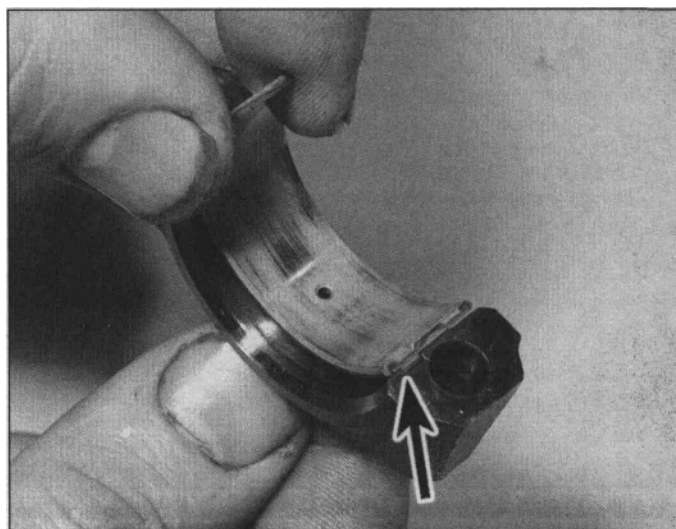
47 With the piston rings correctly positioned, clamp them in position with a piston ring compressor (**see illustration**).

48 Insert the piston/connecting rod assembly into the top of its bore, taking care not to allow the connecting rod to mark the bore. Make sure the IN mark on the piston crown is on the intake side of the bore and push the piston into the position until the piston crown is flush with the top of the bore.

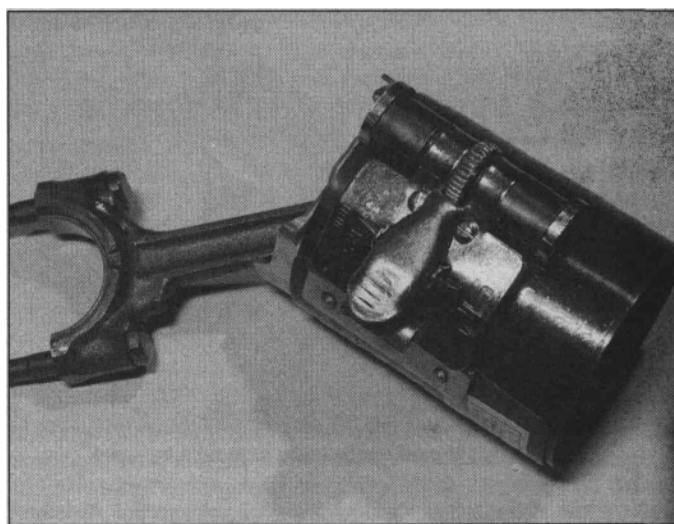
49 Ensure that the connecting rod bearing insert is still correctly installed. Taking care not to mark the cylinder bores, apply molybdenum disulfide grease to the crankpin and both bearing inserts, then pull the piston/connecting rod assembly down its bore and onto the crankpin.

50 Fit the bearing cap and insert to the connecting rod. Make sure the cap is fitted the correct way around so the connecting rod and bearing cap weight/size markings are correctly aligned (**see illustration 29.29**).

51 Apply a smear of clean engine oil the threads and underside of the bearing cap nuts. Fit the nuts to the connecting rod and tighten



29.44 Align the bearing insert tab with the cutout (arrow) in the connecting rod and cap



29.47 Piston ring compressor installed

them evenly, in two or three stages, to the specified torque setting. 52 Check that the crankshaft is free to rotate easily, then install the three remaining assemblies in the same way.

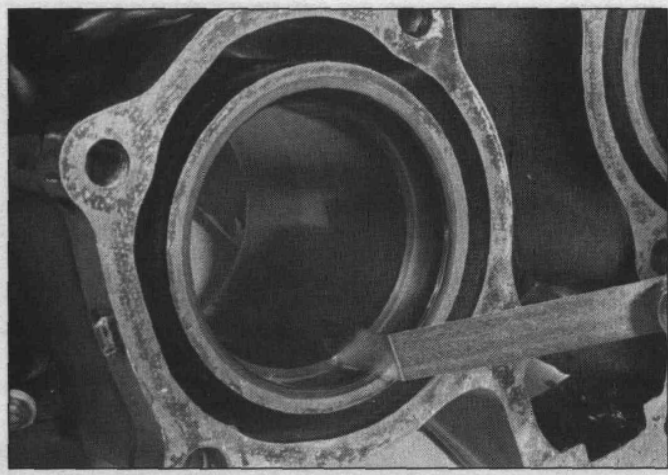
30 Piston rings - installation

Refer to illustrations 30.3, 30.5, 30.9a, 30.9b and 30.9c

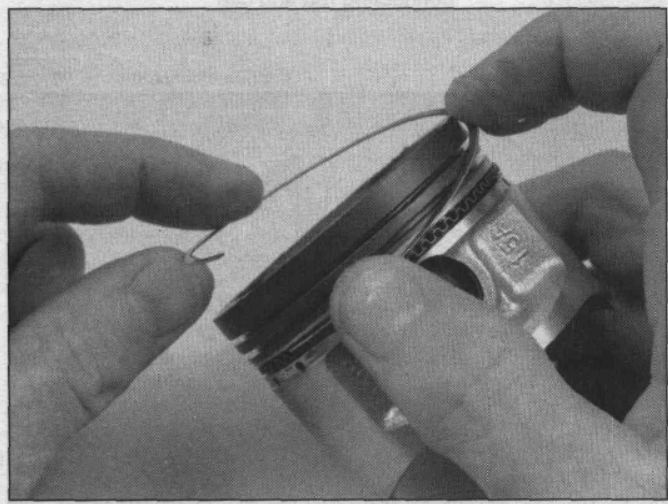
1 Before installing the new piston rings, the ring end gaps must be checked.

2 Lay out the pistons and the new ring sets so the rings will be matched with the same piston and cylinder during the end gap measurement procedure and engine assembly.

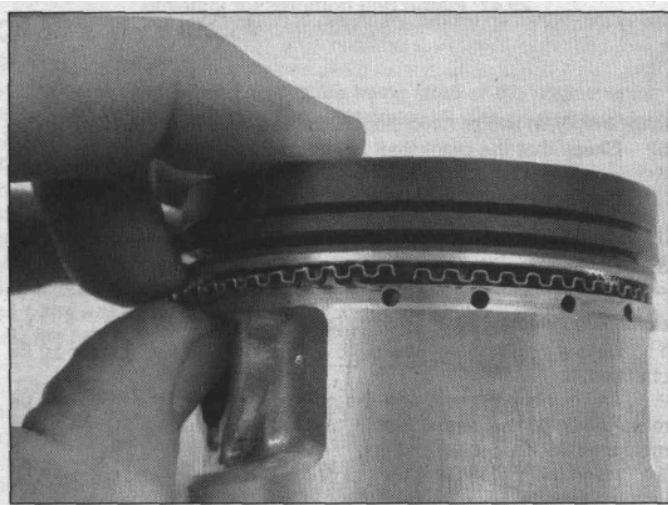
3 Insert the top ring into the top of the first cylinder and square it up with the cylinder walls by pushing it in with the top of the piston. The ring should be about 25 mm below the top edge of the cylinder. To measure the end gap, slip a feeler gauge between the ends of the ring



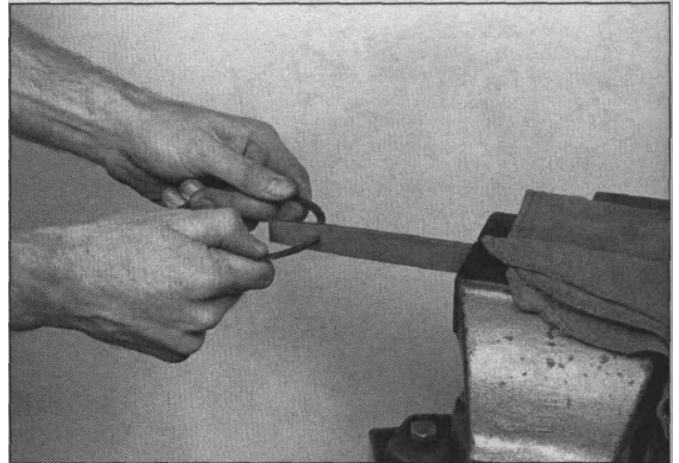
30.3 Position ring squarely in bore when measuring ring end gap



30.9a Install the oil control ring side rails by hand



30.9b Make sure the oil control expander ends don't overlap



30.5 Enlarging the piston ring end gap

and compare the measurement to the Specifications (**see illustration**).

4 If the gap is larger or smaller than specified, double check to make sure that you have the correct rings before proceeding.

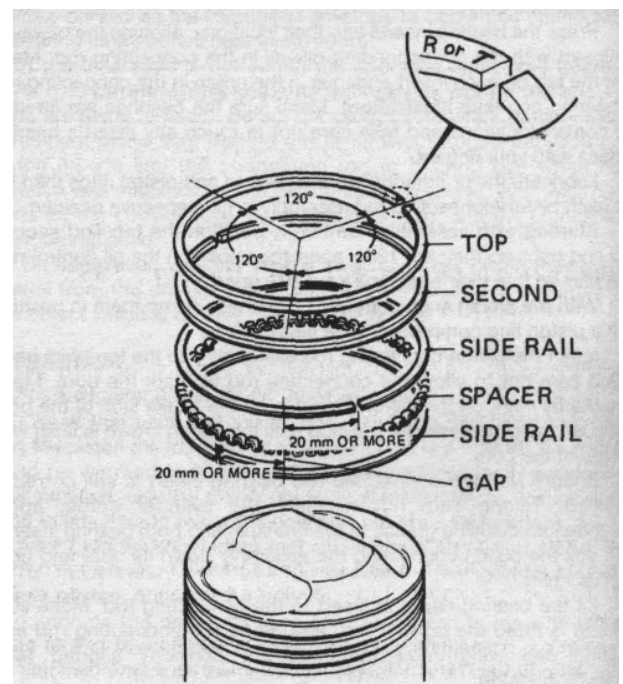
5 If the gap is too small, it must be enlarged or the ring ends may come in contact with each other during engine operation, which can cause serious damage. The end gap can be increased by filing the ring ends very carefully with a fine file. When performing this operation, file only from the outside in (**see illustration**).

6 Excess end gap is not critical unless it is greater than 1 mm. Again, double check to make sure you have the correct rings for your engine.

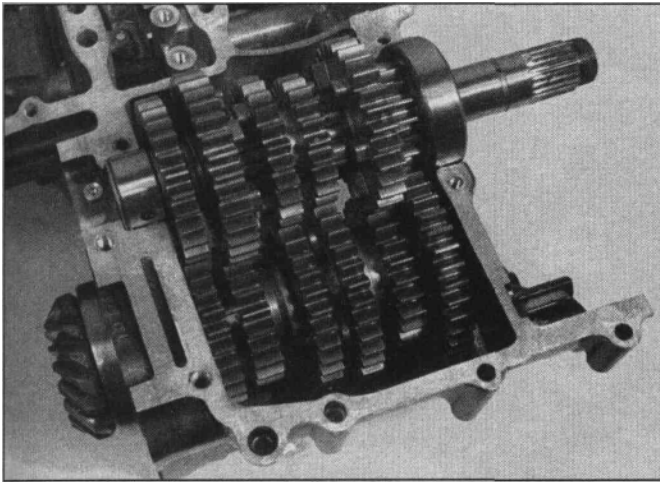
7 Repeat the procedure for each ring that will be installed in the first cylinder and for each ring in the remaining cylinders. Remember to keep the rings, pistons and cylinders matched up.

8 Once the ring end gaps have been checked/corrected, the rings can be installed on the pistons.

9 The oil control ring (lowest on the piston) is installed first. It is



30.9c Piston ring end gap positions



31.2 To measure gear backlash, mesh mainshaft with countershaft in lower crankcase half ...

composed of three separate components. Slip the expander into the groove, then install the upper side rail. Do not use a piston ring installation tool on the oil ring side rails as they may be damaged. Instead, place one end of the side rail into the groove between the expander and the ring land. Hold it firmly in place and slide a finger around the piston while pushing the rail into the groove. Next, install the lower side rail in the same manner (see illustrations).

10 After the three oil ring components have been installed, check to make sure that both the upper and lower side rails can be turned smoothly in the ring groove.

11 Install the second (middle) ring next. Note: *The second ring and top ring are different in profile - don't mix them up.* To avoid breaking the ring, use a piston ring installation tool and make sure that the identification mark (either a T or R) is facing up. Fit the ring into the middle groove on the piston. Do not expand the ring any more than is necessary to slide it into place.

12 Finally, install the top ring in the same manner. Make sure the identifying mark (either a T or R) is facing up.

13 Repeat the procedure for the remaining pistons and rings.

31 Transmission shafts - removal and installation

Note: When disassembling the transmission shafts, place the parts on a long rod or thread a wire through them to keep them in order and facing the proper direction.

1 Separate the crankcase halves as described in Section 24.

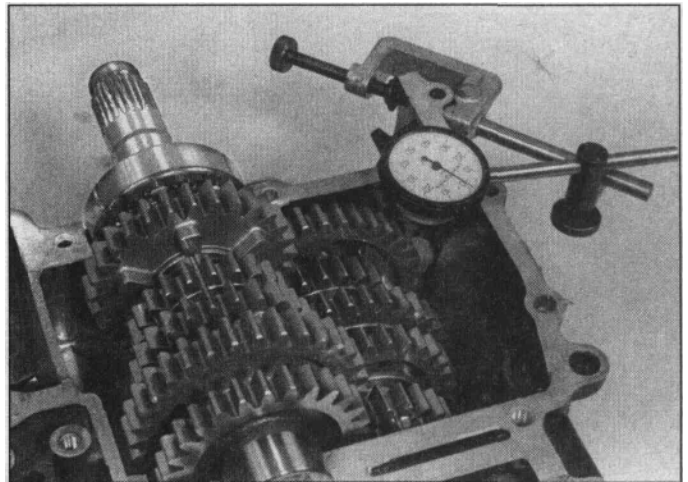
Backlash check (except 1985 through 1988 700/750 Magna models)

Refer to illustrations 31.2 and 31.3

2 Before removing any transmission components, use a dial gauge to check the gear backlash between all mating gears. To do this, remove the mainshaft assembly from the upper crankcase and lay it in position in the lower crankcase, so it is properly engaged with the countershaft assembly (**see illustration**).

3 Backlash measurement is done by setting the dial gauge up so it just contacts the tooth face on one of the countershaft gears (**see illustration**). Then, while holding the mainshaft to keep it from moving, rotate the countershaft gear back and forth with your finger while watching the movement of the needle on the gauge. Jot down the reading.

4 Repeat the procedure on the other countershaft gears that mate with gears on the mainshaft. Compare the readings with the Specifications. If any of the gears have excessive backlash, that gear and the mainshaft gear it mates with are worn and require replacement.



31.3 ... and set dial gauge up as shown

Mainshaft

Refer to illustrations 31.10, 31.13a, 31.13b, 31.14 and 31.15

Removal and disassembly

5 Lift out the mainshaft.

6 Carefully remove the gears, washers, snap-rings and bushings from the mainshaft. Note: *It is very important that all components be kept in their installed order and relative position to each other. It is very easy to mix up transmission components, a mistake which will result in improper functioning of the transmission.*

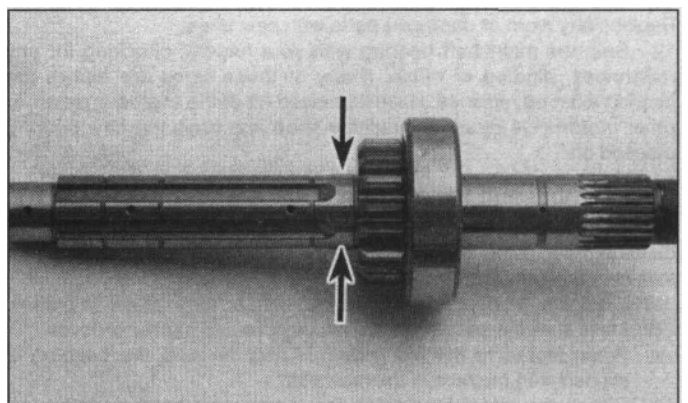
Inspection

7 Clean each part, one at a time, with solvent and dry them thoroughly. Make sure all the oil holes are not clogged.

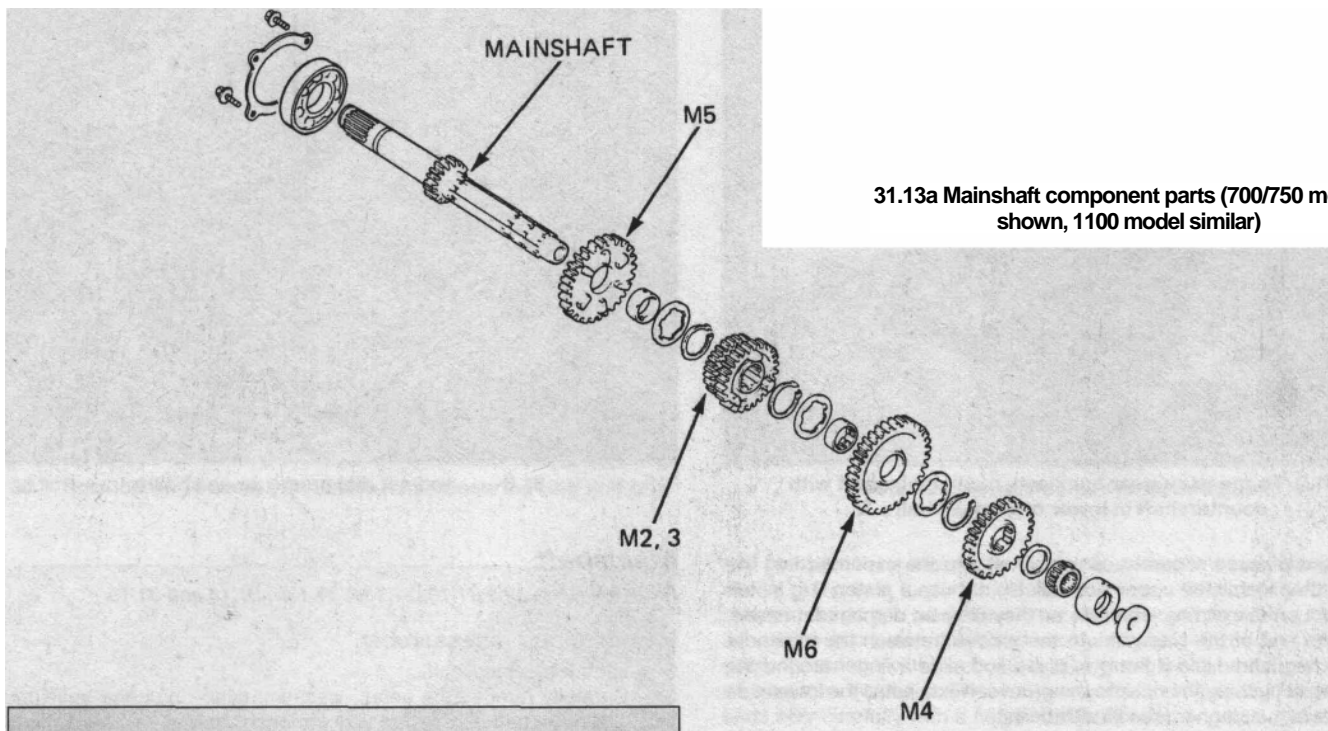
8 Check the gear teeth, the gear dogs and the shift fork grooves for cracks and excessive wear. If the gear dogs are rounded off, replace the gears with new ones. Measure the inside diameter of each gear and compare the results to the Specifications. If excessive wear has occurred, new gears are required.

9 Measure the outer diameter and inner diameter of the gear bushings, as appropriate, and compare the measurements to the Specifications. If they are excessively worn they must be replaced.

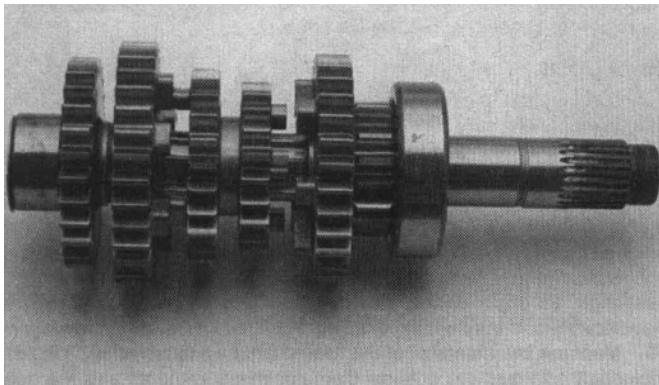
10 Measure the diameter of the mainshaft (see illustration). Use the mainshaft and bushing outside diameter measurements and the gear inside diameter measurements to determine the clearance between the gears and shaft or bushings. If they are excessive, a new mainshaft, bushings, and possibly new gears should be obtained. Also, check the shaft for score marks, cracks and evidence of seizure.



31.10 Measure mainshaft diameter at this point (arrows)



31.13a Mainshaft component parts (700/750 model shown, 1100 model similar)



31.13b Assembled mainshaft

11 Check the thrust washers and snap-rings for wear and distortion. Replace any worn or damaged parts with new ones.

12 Spin the mainshaft bearing with your fingers, checking for any roughness, binding or noise. If any of these signs are found, the bearing must be replaced. Have it pressed off of the shaft at a dealer or other motorcycle repair or machine shop and have the new bearing pressed on.

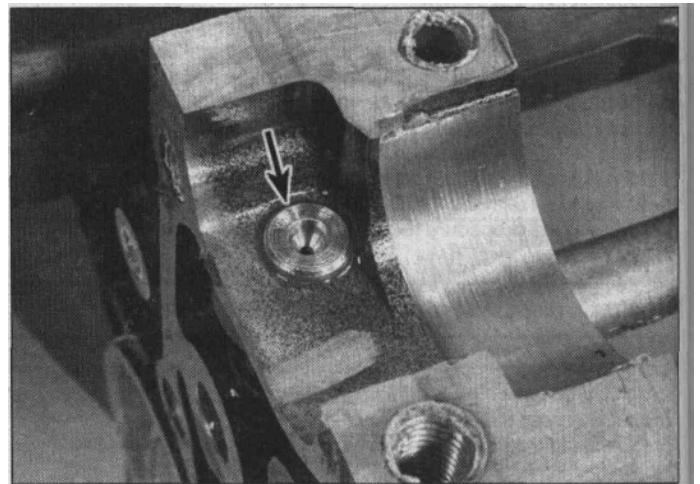
Reassembly and installation

13 Reassemble the shaft components in the reverse order of disassembly, using the exploded view as a guide and noting the following (**see illustrations**).

- Lubricate the contact surfaces with molybdenum disulfide grease.
- Make sure the snap-rings are securely seated in their grooves.
- When installing the M6 gear bushing, be sure the bushing is aligned with the hole in the mainshaft.

14 Check the oil jet located in the lower crankcase near the left mainshaft bearing surface (**see illustration**). Be sure it is not clogged.

15 If the shift drum and shift forks were removed, install them in the



31.14 Oil jet location (arrow) in lower crankcase

upper crankcase (see Section 32). Lay the mainshaft assembly in place. Be sure the center fork is correctly engaged with the proper gear (**see illustration**).

16 Reassemble the crankcases as described in Section 24.

Countershaft

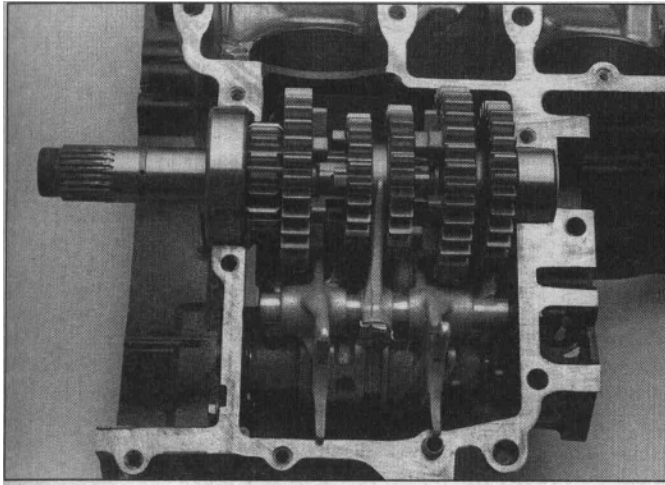
Refer to illustrations 31.18, 31.20, 31.21, 31.23 and 31.27

Removal and disassembly

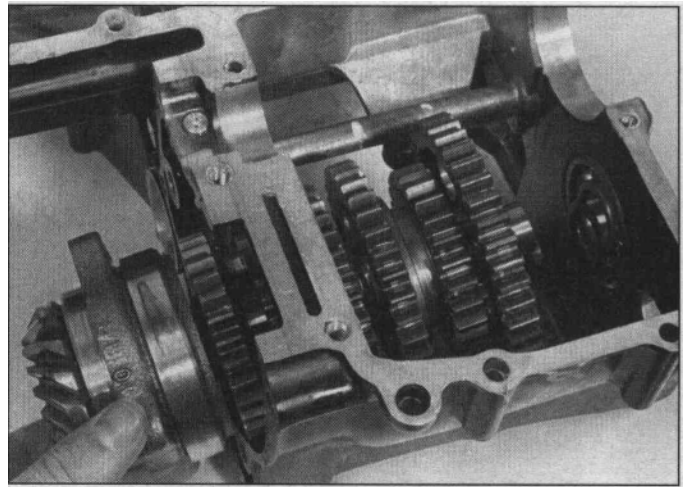
Note: The helical output gear assembly does not have to be removed from the countershaft in order to remove the countershaft from the crankcase, but it must be removed if the countershaft is to be replaced with a new one.

17 Remove the mainshaft if not already done.

18 Before the countershaft can be removed from the crankcase,



31.15 Center shift fork engaged with mainshaft



31.18 Remove C1, C5, C2 and C3 then withdraw countershaft and bearing holder from crankcase

remove the C1, C5, C2 and C3 gears from the countershaft, along with their spline washers, snap-rings and bushings (**see illustration**).

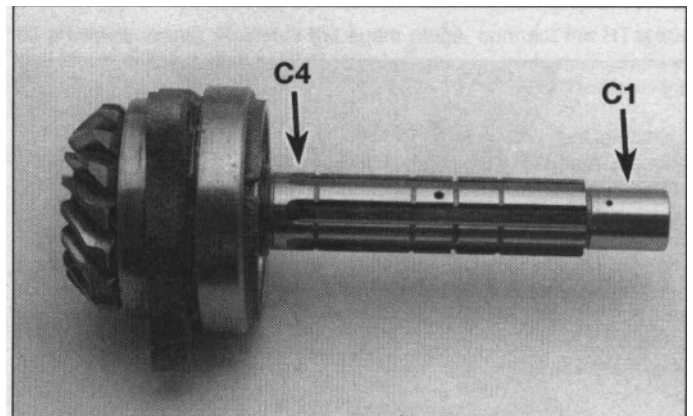
19 After the countershaft has been removed from the crankcase, the remaining gears and related parts can be lifted off.

Inspection

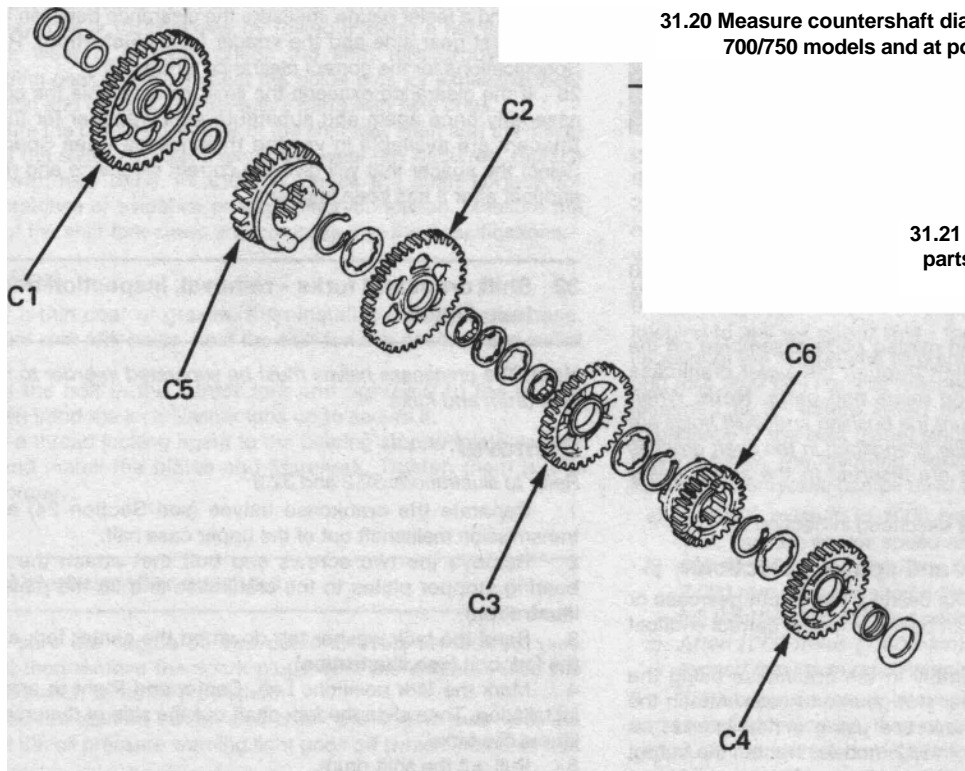
20 Refer to Steps 7 through 12 above, and examine the countershaft components. Measure the countershaft outside diameter at the C1 and C4 gear positions on 700/750 models and at the C4 gear position on 1100 models (**see illustration**).

Reassembly and installation

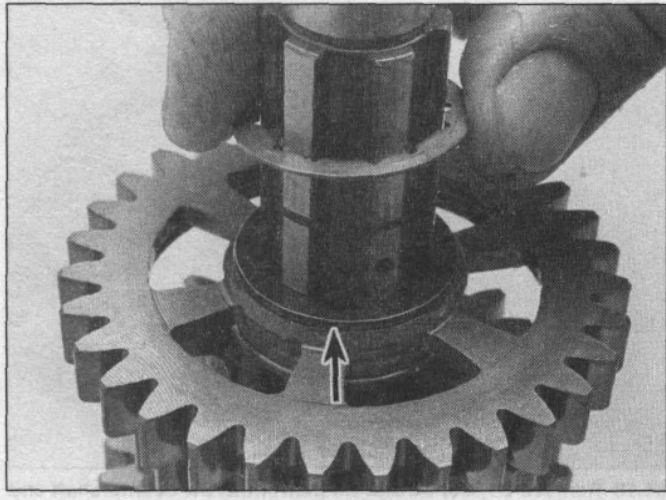
21 Reassemble the shaft components in the reverse order of disassembly, using the exploded view as a guide (**see illustration**).



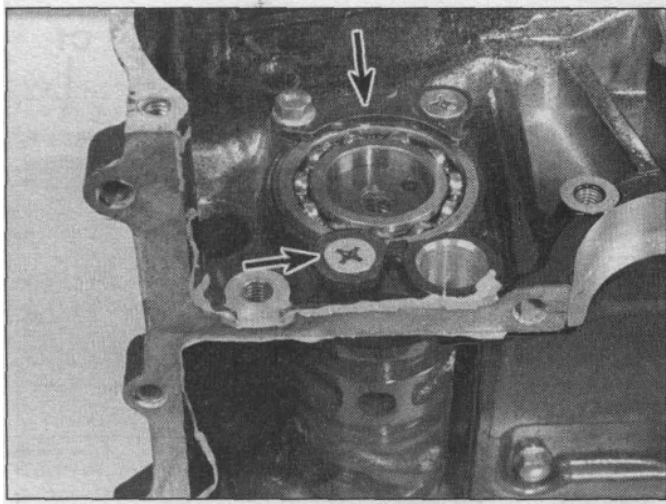
31.20 Measure countershaft diameter at point C4 and C1 on 700/750 models and at point C4 on 1100 models



31.21 Countershaft component parts (700/750 model shown, 1100 model similar)



31.23 The spline collar (arrow) is correctly installed when its tabs are engaged with the shaft grooves



32.2 Shift drum stopper plates

22 As the parts are assembled, lubricate the contact surfaces with molybdenum disulfide grease. Also, make sure the snap-rings are securely seated in their grooves.

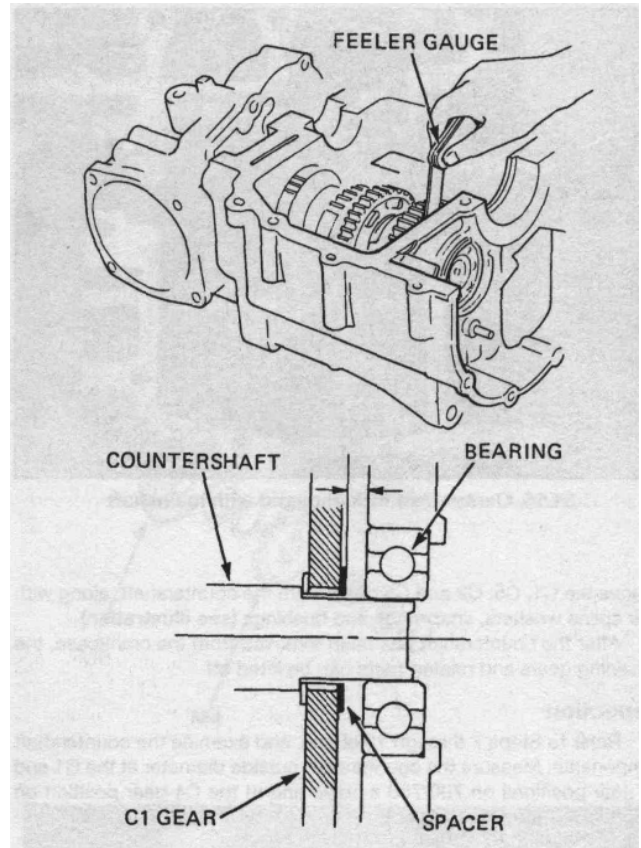
23 With the C4 and C6 gears and related parts assembled on the countershaft, insert the countershaft through the lower crankcase opening. Then install the remaining gears and parts. **Note:** When installing the C3 gear bushing, be sure the bushing and shaft holes are aligned. Also, be sure the spline collar is engaged in the shaft grooves and that the stopper washer tabs are inserted in the spline collar indentations (see illustration).

24 Reassemble the crankcases as described in Section 24.

Countershaft endfloat check and spacer selection

25 Whenever the countershaft or its bearing, the output gearcase or crankcase are replaced, a check must be made for the correct endfloat on the countershaft.

26 Install the countershaft assembly in the crankcase using the original spacer between the C1 gear (1 st gear) and case. Attach the output gearcase to the lower crankcase using a new gasket as selected in Section 23 in the case of 1982 models. Tighten the output gear assembly bolts to the specified torque.



31.27 Countershaft endfloat measurement

27 Using a feeler gauge, measure the clearance between the bearing on the first gear side and the spacer (see illustration). Refer to the Specifications for the correct clearance (endfloat).

28 If the clearance exceeds the limit, disassemble the countershaft assembly once again and substitute a new spacer for the old one. Spacers are available in varying thicknesses - see Specifications. Select the spacer that will give the correct clearance and recheck the endfloat after it has been installed.

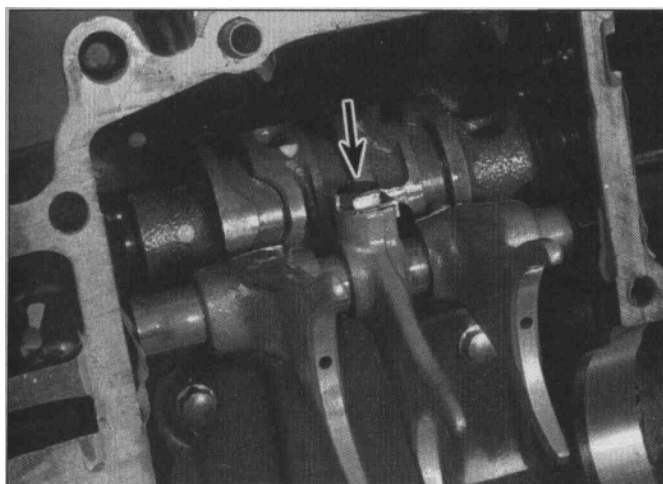
32 Shift drum and forks - removal, inspection and installation

Note: The crankcase halves must be separated in order to remove the shift drum and forks.

Removal

Refer to illustrations 32.2 and 32.3

- 1 Separate the crankcase halves (see Section 24) and lift the transmission mainshaft out of the upper case half.
- 2 Remove the two screws and bolt that attach the shift drum bearing stopper plates to the crankcase and lift the plates off (see illustration).
- 3 Bend the lock washer tab down on the center fork and remove the fork bolt (see illustration).
- 4 Mark the fork positions Left, Center and Right to ensure proper installation. Then slide the fork shaft out the side of the crankcase and lift out the forks.
- 5 Pull out the shift drum.



32.3 Center shift fork is retained by bolt and lockwasher; bend lockwasher up again onto bolt to secure it

Inspection

Refer to illustration 32.8

6 Check the edges of the grooves in the drum for signs of excessive wear. Also, check the shift drum hole and shift fork shaft hole in the crankcase for any scoring or scratches. If wear or damage is excessive, the drum, shaft and possibly the crankcase half will have to be replaced.

7 Check the ball bearing for smooth operation. If noise or binding is evident or there is any sign of freeplay between its inner and outer race, the bearing must be replaced with a new one.

8 Measure the shift fork thickness and compare it to the Specifications (**see illustration**). If it is excessively worn, it should be replaced.

9 Check the shift forks for distortion and wear, especially at the fork ends. If they are discolored or severely worn they are probably bent and will cause difficulty in selecting gears and make the gearshift action heavy; check for trueness by rolling it along a flat surface. If damage or wear is evident, check the shift fork groove in the corresponding gear as well. Inspect the guide pins for excessive wear and distortion and replace any defective parts with new ones.

10 Measure the outside diameter of the shift fork shaft and the inside diameter of the shift fork hole. If excessive wear has occurred, replace the parts with new ones. In addition, check the shaft surface for scoring, scratches or evidence of insufficient lubrication. Measure the thickness of the shift fork claws and compare it to the Specifications.

Installation

11 Apply a thin coat of grease, then install the drum in the case. Lubricate the shift fork holes, hold the shift forks in position and install the shaft.

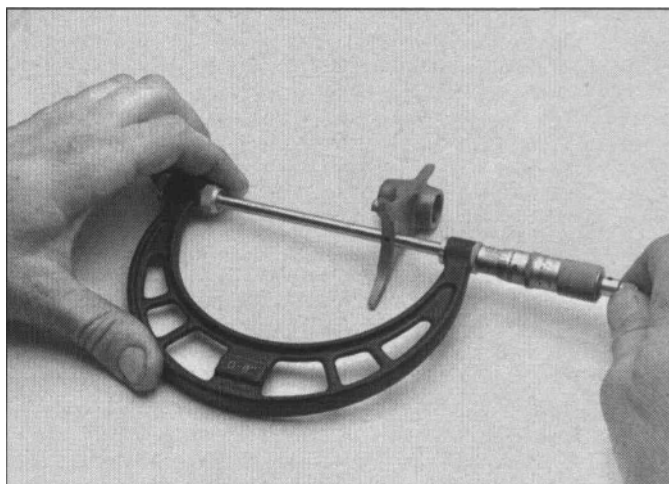
12 Install the bolt in the center fork and tighten it to the proper torque. Then bend the lock washer tabs up to secure it.

13 Apply a thread locking agent to the bearing stopper plate screws and bolt and install the plates and fasteners. Tighten them to the specified torque.

33 Initial start-up after overhaul

1 Make sure the engine oil and coolant levels are correct (see Chapter 1), then remove the spark plugs from the engine. Place the engine stop switch in the OFF position.

2 Turn on the ignition switch and crank the engine over with the starter until the oil pressure warning light goes off (which indicates that



32.8 Measuring shift fork thickness

oil pressure exists). Reinstall the spark plugs, connect the HT leads and turn the stop switch to RUN.

3 Make sure there is fuel in the tank, then turn the fuel valve to the ON position and operate the choke.

4 Start the engine and allow it to run at a moderately fast idle until it reaches operating temperature. **Warning:** If the oil pressure warning light doesn't go off, or it comes on while the engine is running, stop the engine immediately.

5 Check carefully for oil and coolant leaks and make sure the transmission and controls, especially the brakes, function properly before road testing the machine. Refer to Section 34 for the recommended break-in procedure.

6 Upon completion of the road test, and after the engine has cooled down completely, recheck the valve clearances and check the engine oil and coolant levels (see Chapter 1).

34 Recommended break-in procedure

1 Any rebuilt engine needs time to break-in, even if parts have been installed in their original locations. For this reason, treat the machine gently for the first few miles to make sure oil has circulated throughout the engine and any new parts installed have started to seat.

2 Even greater care is necessary if the engine has been rebored or a new crankshaft has been installed. In the case of a rebore, the engine will have to be broken in as if the machine were new. This means greater use of the transmission and a restraining hand on the throttle until at least 500 miles (800 km) have been covered. There's no point in keeping to any set speed limit - the main idea is to keep from lugging (labouring) the engine and to gradually increase performance until the 500 mile (800 km) mark is reached. These recommendations can be lessened to an extent when only a new crankshaft is installed. Experience is the best guide, since it's easy to tell when an engine is running freely. The following recommendations, which Honda provide for new motorcycles, can be used as a guide.

- a) 0 to 600 miles (0 to 1000 km): Keep engine speed below 5,000 rpm. Vary the engine speed and don't use full throttle.
 - b) 600 to 1000 miles (1,000 to 1,600 km): Keep engine speed below 7,000 rpm. Rev the engine freely through the gears, but don't use full throttle for prolonged periods.
 - c) After 1000 miles (1,600 km): Full throttle can be used. Don't exceed maximum recommended engine speed (redline).
- 3 If a lubrication failure is suspected, stop the engine immediately and try to find the cause. If an engine is run without oil, even for a short period of time, severe damage will occur.